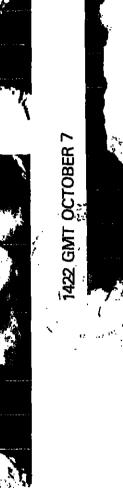
OCTOBER

GMT



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Eos, Transactions, American Geophysical Union

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Hydrology

1130 Croundwater

A. AAA1915 OF DISPENSION II: A STRATITIED CONTIFER

O. Given (Important of Civil Engineering, Autumn University, Autumn, Alabana, 16840), F. I. Mole and J. G. Inlevitie

The dispersion of a communative solute produced as a result of vertical variation of horsulic conductivity in a horizontal stratified adulter of finite thickness is analyzed by applying the moment rethod of Aris to solve the governing advection-dispersion equation describing mass transport. In the analysis, it is assumed that the aquifor is of content thickness and of infinite lateral except, the hodraulic conductivity is a hour function of the varifical coordinate only, and the flow in unfiliraction), parallel to the atratification. The applicable Aris account equations are developed in a suitable ponditionalional form. Analytical solutions are obtained for the seroth and first compute and for the time derivative of the seroth and first compute and for the time derivative of the second teent of the longitudinal concentration distribution for the case of an instantaneous plans source for several idealzed hydraulic conductivity profiles (parabolic, linear, step-function and copine profiles and their Ilmar, step-function and cosine profitor and their own periodic extensions). The analysis gives the three-dependent variation of the longitudinal macro-dispersivity for those idealized cases throughout the transpert deviction of the dispersion process. The results of the sasivain are applied to a field-resource hydrakite conductivity profile and predicted vitues of the longitudinal racredispersivity are expared with field results. An important conclusion from the analyses is that commission the individual of the hosterial conductivity profile which persist over long distances may produce rather large values of longitudinal macredispersivity, which are comparable to those observed in some aquifers and which are much larger than it, as predicted by some pervicts atoutant canalyses. Implications of the annitration to the field dispersion problems are dinumed. Isolate transport, disporation, racrodispersivity, struiffed squileys.

Water Resour. Red., Paper 4M0769.

OF UNITYING THE CONCEPTS OF SCALE, INSTRUMENTATION AND SUCCESSIVE IN THE DEVELOPMENT OF MULTIPHASE TRANSPORT

Sivements in the Detail of Real Prince Transfort Theory

J. N. Combrain (Agranor. Department) of NULT(PHASE TRANSFORT THEOry

J. N. Combrain (Agranor. Department, Furdum University,
Neat Lafavotto, Indians, 47007)
A secondational theory of multiphase transport is presented which combines the concepts of smale, instrumentation, stochastics and time series with the development of transport equations. By dufining the filtering process as a consolution of a ceasure Point a field property, we are not to a process of a consolution of a ceasure Point a field property, we give the first of the property of the property of the capability of the Point Transfort to place of a to nate the seasurement redeemed to frequency space so at to nate the first instrument is defined which filters out high frequency poinc (corresponding to whore distances) and set does not alter the surface of frequency notes in a molitonic, multiphase environment, fortulas are developed to relate the autocorrelation of a field property on one scale of molion to that on any other scale while taking into account the types of instruments used in the measuring process. An equation relating the integral scale on one scale of motion to that on any other scale use any other scale of motion to developed. Process spectra are developed which relate spectra on different scales to the measuring instruments used. By alchessively applying filtering theorems, a historichy of multiscale transport equations of developed. Filtering theses, the transport equations of exclude Highest process is introduced to develop man warrage attract, phases. The concept of a wide-space stationary, argodic process is introduced to develop man warrage autocorrelations and applicate over duales of oction and for different properties are allowed by a manuface attraction of measuring develops. (Cale, multiphase, accoparios, Fifter)

3.10 Oroundwater
Dispersion of Trace Solutes in Floming Ground water
T.A. Hatton (Department of Chamical Engineering, University
of Misconein, Hadison, Misconein, 57766) and E.B. Lightfoot
Conventinad Taylor dispersion theory is used to identify
the dispersion characterization of aimple attacified
squiters. The persentent routinely entiqued from field
tests are shown to be influenced in a non-trivial way by the
inhanogementy of the aquifer as well as by the initial
distribution of solute and by the sampling tenniques used
in their detachication; both the dispersion coefficient and
apparent convective velocity case whight important
translents. These factors are sufficient to emplain the
Well known scales effect for the idealized system malying
furtherwork, simpling procedures any require addition of a
Maint for the idealized system malying
furtherwork, simpling procedures any require addition of a
Maint for the idealized system analyses.
The model is been described
actively an approximate match for yerological standard
actively an approximate match for yerological systems
and the system of the standard of active of the standard of general system.
The control of the system of

Vater Resourt Res., Paper 490818

Water Report Res., Paper 491045

September 4, 1981

Geophysical Research Letters

Regular leave
Late Acquisition of "Primary" Remanence in Some Frosh Basalts: A Counce of Spurious Paleomagnetic
Results (Paper 4L6205)
Re Laie Acquisition of "Primary" Remanence in Some Frash Basalts: A Course of Spurious Paleomagnetic Results (Paper 44.6205)

Results (Paper 44.6205)

Paleomagnetism of the Lower Jurassic Copper Mountain Intrusions and the Geotectonics of Tertune I, Brilish Columbia (Paper 44.6208)

Paleomagnetism of the Lower Jurassic Copper Mountain Intrusions and the Geotectonics of Tertune I, Brilish Columbia (Paper 44.6128)

Fine and Temporature Dependent Convection Models of Cooling Reservoirs: Appliculant to Volcanic Charles R. Carrigen Sills (Paper 44.6038)

Centimeter Scale Heterogeneities and Microstratification in Scalimentary Rucks (Paper 44.6158)

W. F. Marphy III. J. N. Roberts, D. Yule, and K. W. Winkler During Storm Recovery Phase (Paper 44.6163)

Direct Detection of the Precipitation of Ring Current Electrons and Protons Silmulated by Artificial VI.F. Emission (Paper 44.6133)

R. A. Koventhian, M. M. Mogillevsky, O. A. Moltchanov, Yu. I. Galpetis, N. V. Djordis, Yu. V. Jasalov, J. M. Brosqued, and H. Rost Orbit (Paper 44.6101)

A. Eghli, P. Francia, U. Villante SEQUAL/FOCAL: First Year Results on the Circulation in the Equatorial Atlantic
SEQUAL/FOCAL: Editorial (Paper 4L6284)
Winds at St. Peter and St. Paul Rocks During the First SEQUAL Year (Paper 4L6104)
Silvia L. Carzoli and Eli Joel Katt.
Richard E. Paper Surface Wind Measurements in SEQUAL 1 (Poper 4L6093)

Tropical Atlantic Wind Field Variations During SEQUAL: Preliminary Results (Paper 4L6150)

(i. E. Harrison and Vincent J. Cardont (i. E. Harrison and Vincent J. Cardont (ii. E. Harrison and Vincent J. Cardont (iii. E. Harrison an Thermocline Displacement Across the Atlantic North Equatorial Countercurrent During 1983 (Paper 41,6098)

Modes of Variability of the 1983 Thermocline Stand (Paper 41,600)

Lift Joel Katz and Silvia L. Garoff
Silvia L. Garoff Modes of Variability of the 1983 Thermocline Signal (Paper 4L6100)

Drifting Buoy Trajectories in the Atlantic North Equatorial Countercurrent During 1983 (Paper 4L6091).

P. L. Richardson Moored Current Meter Measurements in the Atlantic North Equatorial Countercurrent During 1983 (Paper 41.618) (P Moored Current Meter Measurements in the Atlantic North Equatorial Countercurrent During 1983 (Paper 41-697).

Antonio Marussi 1908-1984



Antonio Marussi, one of the most prominent geodesists of this century, died in Trieste. Italy, on April 24, 1984, at the age of 75. Blessed with good health and a robust physical constitution for most of his life, he was struck down by amyotrophic lateral sclerosis (Lou Gehrig's disease) which he had Marussi is best known among geodesists as

the father of modern three-dimensional geesy. Following an initial presentation at the 1948 Oslo General Assembly of the IUGG, he published in 1949 in the Bulletin Géodésique an article entitled "Fondements de géométrie differentielle absolue du champ potential terrestre," acknowledged now as one of the seminal works of the geodetic literature. In this and subsequent papers. Marussi developed in a general, rigorous, mathematical setting a unified approach to the solution of both geo-metric and physical problems in geodesy. obliterating the artificial distinction between horizontal and vertical which had been built up by geodesists over many years because of observational difficulties. He thus introduced many geodesists to the 20th century by demonstrating the value and, indeed, the necessity of advanced mathematical techniques like the tensor calculus and by anticipating useful data to be obtained by observations on close

extraterrestrial objects like satellites. The depth and influence of this particular breakthrough, however, have been more than matched by the unusual breadth of Marussi's contributions, encompassing the observational and instrumental as well as the theoretical,

AGU and Latin

At its meeting of May 15, the AGU

Council approved two proposals from the Committee on International Participation

(CIP) that represent the first steps in im-

ation and interaction with colleagues in Latin America. The first of these calls for

a commitment of AGU funds to support

next 4 years. The second provides funds

for travel of AGU members who are fac-

ulty members in Latin American universi-

ties to come to the United States in order

to attend an AGU national meeting and

CIP from a number of suggestions, some

of which are still retained as possible addi-

tional activities for the future. The princi-

physics in return for the limited financial

resources that AGU can put into this ef-

fort. We wish to provide contact between

in the United States and a significant

the best research in geophysics being done

number of Latin American scientists, es-

pecially those in a position to pass the information gained to others.

man Conferences will be used mostly to

tists to attend and present their research

the productive interactions characteristic

The funds authorized for the two Chap-

pay travel costs for North American scien-

results. The goal, of course, is to promote

of Chapman Conferences between the two

scientific communities. Some of the funds

may be used to help cover costs of the

conference so that a registration fee can

be kept minimal or eliminated. It is antici-

pated that substantial support for the con-ference will be provided by the local co-

sponsoring organizations.
Planning and execution of the two con-

ferences will be done in close cooperation

with the appropriate local scientific orga-

nizations. The principal convenors will be

m benefit to Latin American geo

ple criterion for the selection was the

These two activities were selected by the

visit appropriate research facilities.

two Chapman Conferences on appropri-

ate topics in Latin America during the

plementing a policy of greater cooper-

Editorial

American

Geophysics

and in practically every aspect of geophysics. In the international geophysical community he was renowned for his participation in a number of expeditions to Karakorum and lindu Kush in which the tectonics and morphology were extensively analyzed in addition to the gravity and topography. At his experi-mental laboratory in the Grotto Gigante near Trieste, he designed the instruments, conducted the observations, and reduced the results for earth tide analysis and determination of the gravitational constant. The wide range of his interests was manifested by a 1975 paper on the paleohydrography of the Trieste area. Before illness curtailed his activity, he was investigating the application of altimeter data to the estimation of variations in the level of the Mediterranean Sea. He was born in Trieste on October 12,

1908. After receiving a doctorate in mathematics at the University of Bologna, he joined the Istituto Geografico Militare (IGM)-the Italian geodetic and mapping agency—in Florence in 1932. During his 20 years of service with IGM, he modernized its geodetic procedures, setting up the Transverse Mercator projection as the standard for Italian topographic maps, converting the reference figure to the International Ellipsoid, and introducing more efficient modes of comput-ing. In 1952, he accepted a professorship of geodesy at the University of Trieste, where he remained for the balance of his career. He soon made his native city the center of gendetic research in all of Italy. Although a dominating personality, he worked well with other people. Bruce Boli and Alan Cook both collaborated fruitfully with him at the Grotto Gi gante Laboratory. He trained and inspired many notable geophysicists of whom probably the best known in the United States is Michele Caputo.

In 1959, he organized an international symposium on mathematical geodesy in Venice, which proved so successful that it has been continued every 3 or 4 years in Italy since then, all except the last in 1981 being personally under his direction. The individually published proceedings of these sympo-sia (now called Flotine Symposia in memory of Marussi's friend and colleague, Martin Hotine) are essential items in any worthwhile geodetic collection. Few parts of the earth have not been visit-

ed and studied by Marussi. He was one of the first to be invited to the People's Republic of China when scientific interchange was opened in the mid-1970's. He was extremely interested in assisting developing countries and devoted much effort to expanding geodetic expertise in Africa. Those geodesists who were privileged to attend the special

Latin American scientists, and the topics

will be selected by consultation between

the local groups and the appropriate AGU

Sections. Once the topic and tentative pro-

will be treated by the standard procedures

Priority in the travel grant program will

be given to faculty members who are sci-

entifically active and who have little access

to funds for foreign travel. These visitors

will be encouraged to contribute a paper

AGU will help, mostly through the Section

officers, to arrange for visits to university.

government, and industrial laboratories in

which work important to the visitor is be-

ing done. These visits are expected to last

chaired by Selwyn Sacks of the Carnegie

Institution, will act as the selection com-

These two projects are the first concrete results of CIP deliberations on a Latin

years. The success of these efforts will de-

termine if additional programs might be productive. Fellowships to support gradu-

ate study by Latin American students are

an attractive prospect, but will require fi-

from AGU resources alone. An investiga-

tion of the kinds and amounts of support

now available for this purpose and of pos-

sible industry support for such a program

nancial support beyond that available

must be carried out before a plan is

evolved. Another activity with great po-

tential is the promotion of travel to Laun America by individual North American

scientists for extended periods for the purpose of working side-by-side with Lat-

American geophysicists in their labora-

tories. Encouragement of the further development of local and regional geophysi-

cal societies is still another promising

AGU is the American Geophysical

Union. These decisions by Council em-

phasize that we are concerned with the health and further development of the

geophysical sciences in all of the Americas.

Carl Kisslinger

Foreign Secretary 1974-1984

American program during the past 2

Latin America of the CIP, currently

mittee for the travel grants.

ut I month. The Sub-Committee on

to the AGU meeting that they attend.

gram are established, these conferences

for all Chapman Conferences.

schools organized by him at the Eutore Majorand in Erice, Sicily, are especially grateful for the opportunity he provided for both learning and association. Marussi was well appreciated by his govern-

ment and by his peers. He was president of the Italian Geodetic Commission and served as president of the International Association of Geodesy from 1967 to 1971. Among his many other honors: he is a member of the Accademia Nazionale dei Lincei, Commendatore al merito della Repubblica Italiana, order of George I of Greece, an honorary doctorate from the University of Graz, and Life Fellow of the American Geophysical Union. In 1978, to celebrate his 70th birthday, two regular issues of the Bollettino di Geodesia e Scienze Affini were combined into a special single volume entitled Modern Trends in Geodesy in which 27 of his associates, friends, and former students dedicated articles to him. Their wide range, from the representation of the earth's potential field to the influence of geodesy on economic development, mirrors the scope of Marussi's own interests.

Marussi will be sorely missed in the geodetic continuity. The void caused by his absence was already evident last year at the IUGG General Assembly in Hamburg, to which he was too ill to travel. At geodetic meetings for more than 30 years, he and his inseparable companion and wife, Lori, were at the center of not only the scientific, but also the social proceedings. His most noticeable trait was his inexhaustible energy. On the mental side he would participate actively in any meaningful scientific, political, or economic discussion, and his interest would never flag. On the physical side, I particularly re-member as indicative a scene in the spring of 1978 at a rocky heach near Erice. My toes had warned me that the water was icy. Antonio, who was 69 at the time, shouted to come enjoy a swim with him, and he promptly dove off a protruding crag into the sea. I didn't follow his advice, but simply gazed with admiration as he emerged refreshed several minmes later. It is inevitable, nevertheless hard to believe, that this energy could finally be

This tribute was written by Bernard H. Chovitz. National Geodetic Survey, NOAA, Rockville,

U.S. Polar **Icebreakers**

An interagency study of the nation's polar ice-breaking requirements through the end of the century was recently completed. The Polar Icebreaker Requirements Study (PIRS) Group presented fleet size alternatives and recommended that the Icebreaker User Council define the capabilities required for new icebreakers. The User Council consists of representatives from the U. S. Navy, National Science Foundation, the Maritime Administration, and the U. S. Coast Guard.

Polar icebreakers are needed for three basic purposes: (1) resupply of Antarctic and Greenland stations, (2) logistical support of polar operations, and (3) scientific research One of the PIRS recommendations was that any new icebreaker designs should enhance science support while meeting the requirements for excert and logistics. The U.S. Coast Guard will soon begin the preliminary

design for a new class of polar icebreakers. The Icebreaker User Council is particularly interested in hearing from the scientific comminus who attributes future icebreakers. should have to carry our scientific and engineering investigations in both polar regions. Any specific comments and thoughts on the equipment, space, and facilities for research support that U. S. icebreakers should have should be sent to AGU members Richard Haves and Lawson Brigham at the Ice Operations Division (G-OIO), U. S. Coast Guard Headquarters, 2100 Second St., S. W., Wash ington, DC 20593; telephone: 202-426-1881; FTS: 426-1881. Any information will be most welcome and will be helpful in defining U.S. icebreaker capabilities for the future.

This news item was contributed by LCDR Lawson W. Brigham, U. S. Coast Guard Headquarters, Washington, D.C.

Antarctic Research Season

As the 1984-1985 Antarctic research season gets underway, more than 300 geologists, astronomers, oreanographers, biologists, at-mospheric scientists, and other researchers are preparing to travel to the south pole to study everything from solar "seismology" to the fossils of long-buried manimals. Approxi-mately 96 science projects are scheduled for this, the 30th consecutive year of U.S. scientific activity at the south pole.

Atmospheric scientists will benefit from a new research facility at Arrival Heights, approximately 2 miles north of McMurdo Station, which replaces older, smaller facilities with a one-story building that will house at least six experiments after it is completed in January. Arrival Heights was chosen as the building site because it is an area of low electromagnetic noise, making it ideally suited to studies of the earth's magnetosphere. Instruments at the new facility will study naturally generated radio wave emissions, auroras, and ultra-low frequency wave activity.

Among the atmospheric science experiments is an investigation by Paul R. Guthals and a research team from Los Alamos National Laboratory to study atmospheric circulation patterns around the Antarctic continent, which may vary with the seasons. The researchers will monitor the transport of a methane tracer released into the atmosphere south of New Zealand, Japanese, French, Australian, and British investigators will take air samples at stations located around the continent, and aircraft will collect air samples between stations in support of this experi-

This season will also see the largest and most ambitious astronomy program ever un-dertaken in Antarctica, as scientists take advantage of the clear, dry air and long observ-

ing seasons to target the sun, stars, and near-by molecular clouds. Martin Pomerantz of the University of Delaware's Barrol Research Foundation will head a French-U.S. project to observe oscillations of the sun that provide clues to the dynamics of the convection zone beneath the visible surface. Pomerantz' group will use a 12.7-cm optical telescope equipped with a resonance spectrophotometer to study the "solar seismicity" first observed in the

Other astronomy projects include intraced observations by Pomerantz of star formation in nearby molecular clouds, the first time infrared telescopes will be used since astronomers hist came to the Autoretic in 1979. Following the onset of austral winter at mid-March, Frank B. Wood of the University of Florida will begin a program of stellar observation, partly to gather data on the suitability of the amarctic sky tor astronomical studies.

One of the 1984-1985 season's major projects will be an expedition by some 19 researchers from six institutions to Seymour Island, off the east coast of the Autarctic permisula, where in 1982 scientists discovered mammalian fossils dating from the Cretacentis-Terriary era. These tossils have been used as important evidence for continental difft, and this season's expedition will mark the third U.S. visit to the island. With William Zinsmeister of Ohio State University as coordinator, the team will spend about a month (from mid-February to mid-March) examining Cretaceous-Tertiary sediments for both plant and animal fossils. In addition, they will collect samples of sediment to my and determine if the iridium anomaly observed in similarly aged sediments around the world also exists in Antarctica.

Ian Dalziel of the Lamont-Doherty Geological Observatory will lead a team studying the Jones Mountain region in Elisworth Land, which is believed to be the boundary area between two "microplates" of West Autarctica. The team will conduct airborne geophysical surveys of the region as part of a continuing program to try and understand the geologic relationships between the eastern and west ern halves of the continent.

Oceanographers have planned a busy research season as well. A team led by Theodore D. Foster of the University of California at Santa Cruz will study a region in the Indian Ocean off the coast of Wilkes Land where there exists a layer of deep water with higher oxygen content and lower temperature and salinity than the water above or below it. The researchers will make the first physical and chemical oceanographic survey of this anomalous layer by gathering water samples and taking data on the water's conductivity, temperature, and density. Another team headed John B. Anderson of Rice University will take piston cores from the ocean floor in the Bellingshausen Sea and conduct seismic surveys in an effort to learn how sediments are transported from the antorcoic continental shelf to the deep scafloor. They also will study sedimentation in polar fjords and collect data on the relationships between glaciers and marine sediments.

An eight-person team from the University of Wisconsin-Madison headed by Charles R. Bentley plans to study the West Antarctic ice sheet, a region of interest to glaciologists and climatologists alike. The team will take that on the sheet's internal movement, ice physics, motion, and history, and will conduct ground-based and airborne radar surveys to etermine such factors as ice thickness and

internal structure. This research season also marks the temporary re-opening of the Siple Research Station located in the far west of Antarctica. The station has been closed since January 20 of this year (Eas, November 11, 1980, p. 906) but will re-open in November 1985 for approximately a year, after which it will be used on an as-needed basis.

News (cont. on p. 692)

WaterWatch



WaterWatch News of the Hydrology Section

Editor: Mary P. Anderson, Department of Geology and Geophysics, University of Wisconsin-Mad Madison, WI 53706 (608-202-2396).

From the Incoming President of the Hydrology Section

On July 1 I began my duties as president of the Hydrology Section of AGU. I took over a healthy Section, recognized as the leading scientific society in the field of hydrology. I also am taking over a Section whose position within AGU is strong and influential. These two facts are a tribute to my predecessors, Peter Engleson and Jim Wallis. They have shepherded the Hydrology Section through an important period of technical and political growth. I will try to maintain the

During my tenure as president I intend to use our new WaterWatch column as a means of communication with the membership. I hope to keep you informed on the technical and administrative issues that arise and also to use this forum to solicit your views on directions that you would like to see us take. As a first attempt at this type of interaction, I have prepared a questionaire, which appears session have v progra for A(questic

In talking with people about the Hydrology Section at annual meetings, I find that most members have only a vague feeling for the administrative structure of the Section. I

would like to try to strip away the mystery.

The Section is administered by an Execu tive Committee, which consists of the President, the President-Elect, the Past President the Secretary Treasurer, the two Water Resources Research editors, the two Annual Meeting Program Chairmen, the Chairmen of 10 Technical Committees, and several a large members. The day-to-day busines carried out by a subcommittee of the Es tive consisting of the President, the Pre-Elect, the Past President, and the Secretary-Treasurer. There is an election every 2 years for the position of Secretary-Treasurer, and Tom Maddock is currently serving his second 2-year term. There is also an election for President of the Section every 2 years, but the successful candidate serves 4 years in all, 2 as President-Elect and 2 as President. Dur-President-Elect, and he will take over the presidency on July I, 1986.

There are a variety of AGU publishing outlets available to members of the Hydrology Section, and it is important that we maintain liaison between these various outlets. For this reason, in addition to Ron Cummings and Steve Burges, who serve on the Executive Committee as the editors of Water Resources Research, I also intend to invite the Hydrology Associate Editor from Eos. Mary Anderson. the Water Resources Monograph Board Chairman, John Bredchoeft, and the Hydrology Associate Editor for Reviews in Geophysics and Space Physics, Bob Hirsch, to join the Execu-

tive Committee as at-large members.

The primary function of the Teclinical Committees is to organize the sessions at the two annual meetings. To this end, the cluirmen of the technical committees will interact closely with the Spring Meeting (Eastern) Program Chairman, Len Konikow, and the Fall Meeting (Western) Program Chairman. Dennis Lettenmeier (through Dec. 81, 1984, after which he will give way to Soroosh Sor-

In addition to the 10 Technical Commit-

tees, there are also four Administrative Committees of the Section of Hydrology, each with a very specific annual or biannual task. These are the Horton Award Committee, the Fellows Committee, the Horton Research Grant Committee, and the Nominations

There are also a large number of AGUwide committees, and the Hydrology Section has representatives on many of them. Of par-

ticular importance to us is the Horton Medal ittee of the AGU Fellows Committee. The Horton Medal (not to be confused with our Section's Horton Award) is given in alternate years. For the 1986 competition, the luee will be chaired by John Brede-

> R. Allan Freeze President, Hydrology Section

AGU Hydrology Section Questionnaire

R. Allen Freeze began his term as President of the Hydrology Section on July 1, 1984. He is anxious to hear from members of the Section as to the directions they would like to see taken over the next 2 years. He is also eager to learn the names of people who might be willing to contribute to the Section or who ought to be considered for our honors and awards. If you could take the time to complete this questionnaire (or any part of it), please return it to:

R. Allan Freeze
Department of Geological Sciences
University of British Columbia
Vancouver, B.C. V6T 2B4, Canada

"	146116.		
2,	Are you currently active in AGU?	Yes	
	If so, in what capacity?		

ireo, iii what capacity /
If not, in what capacity might you be willing to participate?

4. Chapman conferences are smaller conferences designed for in-depth treatment of more specific

topics. Can you suggest topics that might be suitable for the Chapman format? Possible convenors?

Can you suppost topics that you would like to see covered in technical sessions at annual mostlings?

•	(or at a Chapman conference) with other AGU sections?

6. The Water Resources Monograph series published by AGU is intended as an outlet for technology

	transfer. Can you suggest topics that might be suited to this type of treatment at this time?
7	7. The new WaterWatch column in Eos is intended to provide an outlet for news and information of

is or Chapman Conferences, if you	interest to members of the hydrology Section. Do you have any suggestions regarding the content or format of the column?
riews on the various AGU publication	
ams, or if you can suggest candidates OU awards, I urge you to fill out the	
ongire and return it to me.	·
alking with people about the Hydrology	8. Water Resources Research is AGU's primary outlet for research papers in hydrology. Do you have

AGU Fellowship is conferred on scientists who have "attained acknowledged eminence" in their field. The number of Fellows in the Union cannot exceed 3% of the membership. Each Section is limited to three or less new fellows per year. Can you suggest the names of eminent hydrologists who ought to be considered for fellowship?

any suggestions regarding procedures or content? Can you suggest topics (and/or possible authors)

of the nt-	three or less new fellows per year. Can you suggest the names of eminent hydrologiats who ought to be considered for fallowship?
s is	
xecu- sident-	

The Horton Medal is given in alternate years by AGU to a senior scientist for "outstanding contribution in hydrology. The most recent awardees have been John R. Philip, and C. V. Theis. Can you suggest the names of eminent hydrologists who ought to be considered for the Horton Medal?

The Horion Award (not to be confused with the Horion Medal) is given each year by the Hydrology Section to a researcher who has published papers of "outstanding excellence in hydrology." The most recent awardees have been David Woolhiser and Lynn Gelhar. Can you suggest the names of research hydrologists who ought to be considered for the Horion Award?

The Macelwane Award is given to three awardees each year by AGU for "significant contributions by a young scientist." Recipients must be less than 38 years of age. The most recent awardee from the Hydrology Section was Raphael Bras in 1982. Can you suggest the names of any young hydrologists who ought to be considered for the Macelwane Award?

nydrologists who ought to be considered for the Mecelwane Award?

 nembers or possible candidates for future executive appointments	ho wou 97	ild be effe	etive committ
		·	

News & Announcements

Call for Contributions to WaterWatch

Contributions in the form of announcements, news items, and meeting reports, as well as letters to the editor, for the next edition of WaterWatch are due in my office on October 1. Publication is scheduled for mid November.

Let me remind you that WaterWatch is ublished four times a year. I have set deadlines of January 15, March 15, July 1, and October 1 for receipt of material. A new editor will take over January 1,

Mary P. Anderson Editor, WaterWatch

1984 Horton Research **Grant Award**

The recipient of the 1984 Horton Research Grant Award is Javier F. Samper. Samper is a graduate student in the Department of Hydrology and Water Resources at the University ty of Arizona-Tucson. The title of his research project is "A Methodology for the ned Analysis of Hydrological, Hydro chemical, and Isotopic Data From Aquifers." His research advisor is Shlomo Neuman.

The objectives of his research are (1) to develop theoretical and computational tools for the spatial and statistical characterization of iydrochemical and isotopic data from aquifers and (2) to develop statistically based mathematical models incorporating hydrolog ic, chemical, and isotopic data to yield improved estimates of hydraulic and transport parameters as well as groundwater ages. Samper hopes to develop a workable mathematical framework which will allow a coordinated study of many types of hydrogeologic data, including hydraulic, chemical, and isotopic data. Such a systematically and mathematically based method of combined analysis for hydraulic, chemical, and isotopic environmental data is needed to develop a better conceptual understanding of the hydrogeology of any given area and to construct more reliable mathematical models for managing groundwater supply and quality

Meetings

Modeling ET In Hydrology

A special session entitled "Evapotrans tion Modeling: Its Verification and Use will be held during the AGU Fall Meeting in San Francisco, December 3-7, 1984.

This session will address modeling and characterization of evapotranspiration (ET) on a macro scale and is being sponsored by the Unsaturated Zone Committe proaches to ET in hydrology in the past hi regarded it as the residual component of the water balance, but, in most terrestrial applications, ET is the largest component of the local water budget. Causal theory has been developed on the micro scale and is not gener ally a linear fraction of events on a large scale. Recent theory provides help on m scale ET. F. Morton has recently compiled his thoughts on the complementarity of water availability for areal ET and potential ET and will give a presentation on how it works and how it can be used.

Wide area effects of energy input bear upon ET effects, and some effects need spe cial characterization. Radiant energy interact with canopy to present spectral signature effects from angle to sun and sensor. man will present data on the effect of these angles on albedo determination. Forests present a complex canopy to the environment. Fritschen will discuss problems and approaches of characterization and measure

ment of forest ET. Models for applied hydrology must be compatible with the local causal mechan but must also integrate mechanisms realis cally over a wide region. J. Williams will dis-cuss application of models, and H. Morel-Sey toux will incorporate his work on two-phase flow into the evaporation process. J. Halfield then will discuss verification of models, a.

process crucial to valid ET description. Wide area ET requires wide area manage ment of factors. Remote sensing offers the ca pability of synoptic and repeated measurements of many factors on a wide scale. R. Jackson will discuss the use of remote sensing in ET measurement. Some cases require allowance for variance in terrain and vegeta-tion within the larger area. R. Clapp, will discuss relationships of remote sensing to ET es

timation in the humid eastern United States in those places where local anomalies in water flow path are important.

Characterization over wide areas ultimately involves mapping and correlation with local effects. R. Cuenca will describe this application and show maps for Oregon.

This program will supplemented by volun recred papers.

Prospective contributors should send three copies of an abstract as soon as possible to either R. J. Reginato, U.S. Water Conservation Laboratory, USDA-ARS, 4531 East Broadway, Phoenix, AZ 85040 (telephone: 602-261-4356) or J. F. Stone, Department of Agronomy, Oklahoma State University, Stillwater. OK 74078 (telephone: 405-624-6417), cochairmen of the committee. In addition, an abstract original must be sent to Meetings, AGU, 2000 Florida Ave., N.W., Washington DC 20009, by September 12, the Fall Meeting abstract deadline. Prospective contributors may address questions to either R. J. Reginnto or J. F. Stone.

Petroleum Hydrocarbons

A conference on "Petroleum Hydrocarbons and Organic Chemicals in Ground Water-Prevention, Detection and Restoration" will be held Nov. 5-7, 1984 in Houston, Texas. The conference is being sponsored by the National Water Well Association and the American Petroluem Institute. The registration fee is \$225. For more information, contact Diana Sarnovsky, NWWA, 500 W. Wilson Bridge Rd., Worthington, OH 43085.

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Cover. Disequilibrium partial melting in the Skaergaard intrusion, East Greenland. Skaergaard ferrogabbro adjacent to the basal contact of the later Basistopper still appears to have been partly remelted The original ferrogabbro (mottled) has separated into an anorthositic gabbro white inclusions) and a pyroxenitic gabbro (dark veins). The anorthositic gabbro is believed to be composed of the residual crystals from partial melting, and the pyroxenitic gabbro is believed to be the recrystallized partial melt. The composition for the system FeO-CaO-SiOs and may ap proximate the minimum melting compos tion for the plagioclasefree fraction of the ferrogabbro. Incomplete reaction between plagioclase and the partial melt resulted in a melt composition that does not correspond to the equilibrium entectic for the system. The ice ax in the bottom right is marked in centimeters. (Photo courtesy H. R. Naslund, Department of Earth Sciences, Dartmouth College, Hanover, NH 03755).

Organics in Soils

A symposium entitled "Mechanisms of Transformations of Organics in Soils, Sediments and Groundwater" has been organized as part of the 1984 International Chemical Congress of Pacific Basin Societies to be held Dec. 16-21 in Honolulu, Hawali. The organizers are Donald Macalady (Colorado School of Mines), John A. Cherry (University of Waterloo), and A. Otsuki (National Institute for

nvironmental Studies, Ibaragi, Japau). There will be five sessions during the symsium: Sorption, D. L. Macalady, presiding; Groundwater Processes, J. A. Cherry, presiding; Processes in Soils and Sediments, D. L. calady; Sorption, Transport, Diagenesis;

Meeting Report

Sediment Storage

The special session on "Sediment Storage Rivers and Estuaries," which was held at the AGU Spring Meeting, included 14 pa-pers, most of which discussed an aspect of sediment storage in rivers. Two papers, one by Brush and another by Smith, Shoemaker, and Miller covered topics in estuarine sedimentation. In general, the papers in the session could be divided into two main categories: Papers that discussed long-term sedimentation rates and methods of dating sediments, and papers that discussed loca-

tions and mechanisms of sediment deposition. Obviously, the time scale determines not only the methods of analysis, but also the scientific questions that are asked. This was demonstrated by the two summary papers. Meade discussed short-term sedimentation rates and the role that channel morphology and slope play in determining sites of sediment deposition. Trimble presented longterm models of sediment storage and erosion for different climatic zones.

There is much research that needs to be done in order to understand the processes of sediment deposition. Many of the papers presented in the session were case studies that detailed local controls on sediment storage. For example, Nolan and MacDonald in separate papers discussed how organic debris affects the movement and deposition of sediment. In order to be able to predict sediment storage adequately for sediment budget models, we will need a better understanding of the controls that nonalloyial features, channel morphology, gravel pavement, and other factors play in determining the sites and amounts of sediment deposition. These pa-

pers are another step in that direction. Many of the papers on long-term sediment storage were at least indirectly concerned with methods of dating the material. The papers by Brown et al. and Pavich et al. added fuel to the continuing debate about the use-fulness of ⁱⁿBe in dating recent sediments and soils. Brakenridge discussed a case of progressive deposition on stream terraces in Tennessee that suggests that stream terrace treads are not necessarily time stratigraphic markers. Perhaps we will be able to understand stream terraces better when we under stand the mechanisms of sediment deposition. For the present, however, we are still learning about depositional processes by examining the stream terraces.

This meeting report was contributed by Karen ... Prestegard, Franklin and Marshalt College, Lancaster, Pa.

Hillslope Hydrology

A broad area of hydrology was discussed during the session on Hillslope Hydrology at the AGU Spring Meeting in Cincinnati. This is obvious by glancing through the abstracts, published in Eas (April 17, 1984, p. 215-

C. R. Amerman outlined the various flow

processes at hilislopes observed in the North Appalachian Experimental Watersheds (Coshocton, Ohio). There the sequences of geo-logical strata primarily determine the existence or absence of shallow water tables, subsurface flow, and springs in space and time. J. A. Lynch and E. S. Corbett (School of Forest Resources, Pennsylvania State University and NEFES, U.S. Forest Service, respectively demonstrated the importance of antecedent soil moisture with respect to the run-off producing areas. Their experimental system allowed for sprinkling various parts or the whole area of a 7.9 ha forested watershed. The response hydrographs showed two peaks, their timing depending on antecedent soil moisture (ASM) as determined with a neutron probe. At low ASM the first peak occurred shortly after the cessation of rainfall, whereas at high ASM, peak flow lagged several hours behind the cessation of rainfall. Both presentations demonstrated once more the strenuous work involved in collecting reliable field data and making them available for further investigation. T. Dracos (ETH Zuerich, Switzerland) used two-dimensional sand tank experiments to investigate fast ground-water response upon infiltration. He stressed the importance of hysteretical effects of the water-content-pressure relationship in the

capillary fringe immediately above the water table, R. E. Smith (USDA, Fort Collins) and R. H. B. Hebbert (University of West Australia) presented their model on flow processes at the hill slope scale and compared its performance with piezometer response data that were observed in an Australian watershed. They also outlined some model application including the assessment of soil salinity. C. B Burke (Flarza Engineering Co., Chicago) and D. D. Gray (West Virginia University, Mor-gantown) introduced a finite element computer model that combines subsurface, over-land, and open channel flow. They discussed the effects of layered soils on the resulting stream hydrograph as well as the impacts of rainfall characteristics and antecedent moisture conditions on it. K. M. Loague and R. A Freeze (University of British Columbia) concluded the session with disenchanting comparisons of three different rainfall-runoff modeling techniques (i.e., regression model, unit hydrograph model, and quasi-physically based model) on small upland catchments. They hope to improve the performance of the three models by refining the soutial ar-

rangement of the rain gauges.

The aspect of hydrological experiments and measurements at the hill slope scale fell somewhat short, and several of the presentations would also have fit into a program of a session on Catchment Hydrology as well. The vivid discussions, however, indicated the interests in the topics presented. Despite the fact that the program was shortened by the cancellation of two previously scheduled papers, there was not time to appreciate fully all the contributions from the 50 to 70 partici-

This meeting report was contributed by Peter F. Germann, Department of Environmental Sciences, University of Virginia, Charlottesville, Va.

Miscible and Immiscible Transport in Groundwater

The current conventional theory for transport of solutes in groundwater was fully developed by the 1960's. Attention then focused on the development of analytical solutions to the governing equation. By the late 1960's, the increasing efficiency of digital computers, coupled with the restrictive assumptions requir**e**d for analytical solutions, led to a major mphasis on developing deterministic, distributed-parameter, numerical simulation models. Several numerical models that solved the conventional solute-transport equation were developed in the early 1970's and initially applied to scawater-intrusion problems. Toward the middle and late 1970's, many applications involved hazardous and radioactive waste disposal problems. Almost all of these applications involved miscible transport. With the increased application of transport models to field problems, certain deficiencies in transport theory were identified. The deficiencies include the mathematical descriptions of hydrodynamic dispersion, reaction processes, and flow and transport in fractured rocks. Therefore, in the latter half of the 1970's and the beginning of the 1980's, considerable research was and continues to be directed toward improving our understanding of these

processes in the saturated zone. Also, in the 1980's, work increasingly focused on immiscible transport as more and more waste disposal sites were observed to contain nonacqueous pliase liquid (NAPL), and oil spills were noted with increasing fre quency. In the first case, some commo posed chemicals, such as chlorinated hydrocarbons, are often denser than water, whereas oil or petroleum products are usually lighter than water. Both problems involve im-

niscible transport. Because of the interest in these topics, a special session on "Miscible and Immiscible Transport in Groundwater" was included in the program of the 1984 AGU Spring Meeting. The papers covered a wide variety of research topics including (1) flow and transport in fractured rocks, (2) combining geochemis try with groundwater flow and transport, and (3) miscible transport of multiple species.

bled to discuss the process of hydrodynamic dispersion. Several questions were addressed: (I) How much have we learned in the last 10 years? (2) Why do most available models still use the conventional dispersion theory despite observed discrepancies? (3) Do new theories require too much field data to be practi-

The papers that considered miscible transport included several that emphasized chemical processes. These reflect the need to incorporate chemical reactions into transport models. Different types or classes of reactions require different mathematical treatment. Sorption has commonly been represented b \mathbf{z} distribution coefficient (K_d). However, in many cases this approach inadequately de-scribes the actual chemical processes and the observed chemical changes.

Among the other papers on miscible flow were several that mainly emphasized the physical aspects of the problem. One presented results from a detailed field experiment in which the classical solute-transport equation was applied to field data and a good match was obtained, leading to the conclusion that the conventional advection-dispersion model



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can be successfully used for the analysis of field-scale experiments. Another considered a stratified aquifer in which the vertical component of velocity is zero. It was then suggested that scale-dependent dispersion coefficients are a function of various averaging processes and of our knowledge (or perhaps, ignorance) of the three-dimensional spatial distrioution of the groundwater scepage velocities.

Considerable work has recently been done on immiscible transport. Many of the theoretical concepts and modeling approaches pertaining to this problem had originated in the petroleum industry. However, because of the different physical environment of deep petroleum reservoirs compared to shallow aquifers, as well as different incentives and areas of concern in the petroleum industry, there is a great need to adapt and extend this work. Also, the physical, chemical, and hydrological processes and data needs that are unique to he scale and environment of shallow ground water systems need to be investigated.

Several papers on immiscible transport to cused on numerical models. Most considered three phases: air, water, and nonaqueous liquid. Some included physical, chemical, and biological processes. Some were capable of simulating the movement of an organic in all three fluid phases. Solution of the resulting system of equations is clearly not a trivial ex-

As was indicated by the various models presented, we have come a long way in the past few years in our capability of simulating nultiphase flow. A variety of computer codes now exist, but, as many authors have pointed out, the necessary input data do not exist. Only one set of relative permeability curves was presented, and this was for TCE. This type of data does not exist for most solvents and chlorinated hydrocarbons found at spill sites or landfills. In addition, to characterize sites where nonaqueous liquids exist, in situ water and nonaqueous liquid saturations need to be measured or determined. Such data do not exist at these sites. Therefore, the next major advance in this problem area may not come until this type of data becomes

The Panel on Dispersion included five internationally recognized experts on dispersion: Emil O. Frind (University of Waterloo), Robert A. Greenkorn (Purdue University), Lvnn W. Gelhar (Massachusetts Institute of Technology), Fred J. Molz (Auburn University), and George F. Pinder (Princeton University). The discussions focused on the engths and weaknesses of the conrepresentation of dispersion as a Fickian process (that is, the dispersive flux is propor onal to a dispersion coefficient and the concentration gradient). There was a general consensus that the observed dispersion in the field represents the integrated effects of a variety of phenomena or processes that can lead to scale-dependent non-Fickian disper-

It is clear from the symposium that the theory and practical applications of the theory regarding chemical transport in groundwater represent a relatively young and still evolving science. First, the conventional equations do not always describe the processes adequately. Second, available numerical methods do not lways solve the equations accurately and efficiently. Third, we never have enough data to describe the field situation unequivocably (both for physical and chemical parameters and for observations of dependent variables).

This meeting report was prepared by James W. Mercer, Geotrans, Inc., and Leonard F. Konikow, U. S. Geological Survey.

Water Watch (cont. on p. 692)

Kisiel Memorial Lectures

The third Kiesiel Memorial Lecture was given on February 23, 1984, by John D. Bre-dehoeft of the U.S. Geological Survey. The title of his talk was "Water Management: Who are the Managers?"

The text of the second Kisiel Memorial Lecture, which was delivered by Myron Fiering of Harvard University on March 10, 1983, is now available from the Department of Hydrology and Water Resources, University of Arizona, Tucson, AZ 85721. The cost of the 20 page booklet is \$3.00 per copy, and checks should be payable to the University of Arizona. The title of Fiering's talk was "The Real Benefits from Synthetic Flows: Reflections on 25 Years With the Harvard Water Program." According to the foreword by Nathan Buras of the University of Arizona, "The second Kisiel Memorial Lecture captures, in a sense, the kernel of the quantur jump which occurred in the late fifties and early sixties in our perception of the complexities of the hydrological phenomena and man's relation to them." According to Buras, "In the sixties, young Ph.D.'s sallied forth from their universities into the real world spreading the good news that, at last, complex water resource problems in which imperfectly understood natural phenomena affected by anthropogenic interventions can be neatly dissected by the application of systems analysis and the use of mathematical mod-. The second Kisiel Leaure presents and discusses a philosophical basis which underlies the discipline called 'water resources.' The philosophical hasis, together with the scientific foundation provided by hydrological sciences, are the conceptual framework with

Supporting Groundwater **Chemical Transport** Models

The growing realization that many of the challenging questions regarding contaminant transport in groundwater must be resolved by careful field experiments, led to the convening of this symposium, which was sponsored by AGU's Groundwater Committee. The half-day symposium was held during the recent spring AGU meeting and attracted around 150 individuals.

The 13 papers presented included five invited talks. A list of authors and complete abstracts can be found in Eas (65, April 17, 1984, p. 206). Three papers discussed the results of controlled field tracer tests performed at the Chalk River Nuclear Laboratory and Borden landfill sites in Ontario, while three other papers covered tracer tests (one involving the use of heat as a tracer) at sites in Alabama and Illinois. One of the tests at the Chalk River site included the equivalent of 750,000 point measurements of iodine 131 during a natural gradient tracer test at distances as far as 40 m from the injection well. These papers demonstrated that dispersion in principle can be described by the classical advection-dispersion model provided that accurate three-dimensional velocity and permeability distributions are measured. When this is done, the resulting dispersivities are not scale dependent and are quite close to laboratory measurements. The papers also demonstrated that organic contanimants may be subject to chemical nonequilibrium processes during transport.

Three papers discussed on-going long-term tracer studies. D. B. Stephens described an

Field Methods for

for at least 2 years. Intrumentation will include neutron moisture probes, porous cup samplers, tensiometers, and themistors placed throughout a 40-in thick unsaturated zone. D. L. Fryberg described an on-going study funded in part by the U.S. Environmental Protection Agency involving Stanford University and the University of Waterloo. A natural gradient tracer test is being performed at the orden Landfill site in Ontario, where in Autracers and five halogenated organic com-15-hour period. Since then, solute plumes

unbitious field experiment at Socorro, N. M.,

three-dimensional nature of dispersion in un-

saturated media at a scale representative of

electric utility waste seepage problems. The

experiment will involve the pulsed applica-

tion of water and tracer over a 900 m2 area

designed to collect data for studying the

gust 1982 a solution containing two inorganic pounds was injected into the aquifer during a have been monitored by using multi-level sampling devices. O. Güven described a tracer study being performed in a confined aqui-fer near Mobile, Alabama. This study is being funded by the U.S. Environmental Protection Agency and is designed to measure the vertical and lateral variations of horizontal hydraulic conductivity by measuring the vertical variation of horizontal scepage velocities in the vicinity of fully penetrating injection wells operating at 15 Vs. The long-term objective of the experiments is to develop field methods to quantify the major advective as-pects of solute transport which seem to be the

minant dispersing mechanism in many

Another paper dealt with measurement of roundwater velocity using a downhole conductance electrode in a flow cell which measures the dilution of a salt tracer. The remaining three papers dealt with analyses of field data collected to assess exisiting contamination problems. These papers included dis-

cussions of problems at an unnamed hazardous waste site, at a facility for uranium mil tailings, and at the Chalk River Nuclear Lab-

The most fundamental problem in quanti fying solute transport is the high degree of anisotropy and heterogeneity of natural aquifers. The paper by Killey and Moltyaner strikingly demonstrated that there is hope for measuring such variations, although it may be a long time before such methods become practical for widespread use. Morcover, several papers described three-dimensional experiments or analyses, implying that many are abandoning the habit of averaging aquifer properties in the vertical direction, an a proach which causes serious conceptual difficulties when applied to contaminant transport. It seems that many groundwater contamination problems are intrinsically

Despite overwhelming measurement difficulties, it appears that existing knowledge can be applied in a useful way to solve groundwater contamination problems. The paper by Schalla et al. for example, described how an interactive and interdisciplinary approach including data gathering, kriging, model calibration, and computer simulation resulted in an evalution of a contamination problem adequate for the design of remedial action alternatives. Although such successes are encouraging, perhaps the most improtant conclusion of this special session was that sophisticated field measurements are necessary in order to understand the complex phenomena associated with solute tranport in groundwater in away that will allow for a general quantitative approach to be developed.

This meeting report was written by Fred J. Molz, Auburn University, Auburn. Ala., and Mary P. Anderson, University of Wisconsin-Madison, Madison, Wisc.

News (cont. from p. 689)

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Upcoming Hearings BOOKS in Congress

in which the development and utilization of

regional water resources take place."

The following hearing has been tentatively scheduled by the Senate. Dates and times should be verified with the committee or subcommittee holding the hearing; all offices on Capitol Hill may be reached by telephoning 202-224-3121. For guidelines on contacting : member of Congress, see AGU's Guide to Legislative Information and Contacts (Eas., August

28, 1984, p. 669). September 24: Hearing on Antarctica by the Science, Technology, and Space Subcom mittee of the Senate Commerce, Science, and Transportation Committee. Room SD-253, Russell Senate Office Building, 9:30 A.M.—

Meissl Memorial Senior Scientist

Beginning in 1976, the Committee on Geodesy of the National Academy of Sciences/ National Research Council has administered a Senior Scientist Program supported by the National Geodetic Survey of the National Oceanic and Atmospheric Administration (NOAA). Under this program, awardees have spent up to a year in residence at the National Geodetic Survey, conducting research in geodesy and related fields. Through the summer of 1984. 15 prominent scientists have participated, producing more than 20 papers published in a NOAA publications series or n professional journals.

The second awardee was Peter Meissl, Professor of Geodesy at the Technical University of Graz, Austria, who spent 8 months during 1977 at the National Geodetic Survey. His work, "A Priori Prediction of Roundoff Error Accumulation in the Solution of a Super-Large Geodetic Normal Equation System, was released as a NOAA professional paper, of the permanence of the achievement. His contribution was so outstanding that he was invited to return for the summer of 1982. But, tragically, in May 1982 he was killed in a mountain-climbing accident near Graz.

The Committee on Geodesy and the National Geodetic Survey are continuing this program, and the Committee is currently considering applications for periods after 1985. As a tribute to Peter Meissl, a most distinguished scientist, the program henceforth will be formally designated the Peter Meissi Memorial Senior Scientist Program

For more information, contact Bernard II. Chovitz, Chief Geodesist, NGS/NOAA, Rockville, Md. 20852 (telephone: 301-443-8531).

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Rock-Forming Minerals

W. A. Deer, R. A. Howie, and J. Zussman vol. 1A, Orthosilicates, 2nd ed., Longman, New York, ix + 919 pp., 1982, \$149.95.

Reviewed by J. Stephen Huebner

Volume 1A is the second of a series of revisions that the authors are preparing from their original five-volume work on rock-form ing minerals, which is a standard reference for petrologists and mineralogists. Revision of the original series is necessary because of the explosion of the mineralogical literature, particularly in the specialities of microprobe chemical analysis, electron microscopy, intercrystalline and intracrystalline element distributions, mineral physics and thermodynamics, and phase equilibria. Many of these fields ques were only in their infacy when the first edition was prepared 20 years ago. The increase in the published literature has been so great that volume 1A requires 5 times as many pages to deal with one half of the mineral species covered in volume 1 of the first edition. For example, mullite, which was only mentioned briefly in the sillimanite section of the original edition, is now allotted its own 17-page section. Clearly, this second edition supplants the first with regard to pe and quantity of material covered.

Each section describing a particular mineral or mineral group includes an introduction. descriptions of the crystal structures and distinguishing features, and a reference list. Chemical compositions, cation distributions, experimental studies, physical properties, and paragenesis are summarized for each mineral species. The sections on chemistry, cation distributions, and references are enlarged dramatically from those of the first edition. Surprisingly, the sections on distinguishing fealutes are little cha ged and, as a rule, do not take advantage of new microprobe and electron microscopy techniques that help make

The authors collect and summarize, but do not purport to evaluate, the literature. Their made of presentation is one of vignettes, each a sentence to a paragraph long, summarizing a cited paper. Many vignettes are accompanied by reproductions of original figures. It is up to the reader to synthesize, to build bigger ideas from the collected facts. Little attempt is made to estimate the quality of the information, a lack that will be obvious to specialists but that might prove misleading to workers from other fields of science.

The highly structured organization is important because the index does little to help the reader locate particular topics: The index regurgitates the headings within the text but adds few entires. It is little more than a table of contents, arranged alphabetically. For example, if a subject such as diffusion in olivine does not warrant a heading, it is not likely to appear in the index, even though it may be discussed. (Self diffusion and interdiffusivity do appear, however.) As almost 300 pages are devoted to olivine alone, knowledge of

the highly structured organization is neces-sary to find information hidden within the text. Several minutes of time will be well spent in comprehending the author's scheme

'olume 1A is an excellent doorway into

the mineralogical literature. It may also be the last authoritative book on orthosilicates i a field that in the future may rely upon microtiche and computer files. The reference lists are fabulous. Where else can you find 1579 printed references to forsterite-favalite? Or for that matter, 252 complete chemical analyses of garnets? With its companion volumes, 1A is the single most convenient reference to, and summary of knowledge about. the major rock-forming minerals. It should be available for consultation by all mineralogists, petrologists, and, because of the newly increased coverage, geophysicists who are interested in the physical properties of such minerals. The cost is probibitive for most individuals, but most libraries and some special ists will want to acquire these volumes. This new edition will be particularly valuable for institutions that have no machine-searchable reference base or that lack the primary literature from which the information in volume 1A is drawn. In such institutions, volume 1A will identify the papers that individuals doing research should obtain first.

J. Stephen Huebner is with the U.S. Geological

Komatiltes

N. T. Arndt and E. G. Nisbet (Eds.), George Allen & Unwin, Boston, Mass., xvii + 526, 1982, \$75.00.

Reviewed by Terry Klein

Since komatiites were first described in 1969, we have wondered what they are, what they look like, where they are, and how they got there. Arndt and Nisbet's well-edited, vell-illustrated volume provides a good basis and excellent resource book for the geologist that wants to know more.

Komatilies, an outgrowth of the 1979 Penrose Conference held in Val'Dor, Quebec, consists of seven parts with 29 chapters by 44 authors. Each part has a helpful editorial introduction that gives background citations, lends historical perspective, and summarizes the section's content. The book's purpose— "to summarize our present knowledge of komatiites"—is accomplished well. Because the proliferation of literature has slowed since the 1970's, only a few significant papers pubished after 1981 are missing from the reference citations.

Appropriately, Viljoen and Viljoen, who first used the term "komaljite" to describe ultramafic volcanic rocks from Barberton Mountain Land, wrote a good historical review for the introductory section. In chapter 2, editors Arndt and Nisbet answer the oftasked question, "What is a komatiite?" The editors' simple definitions of komatilies and their associated rocks provide consistent

terms that unify the concept of komatite for

The 12 short chapters of part 2 (Regional Surveys) exemplify the wide distribution of komatiites. Viljoen et al., Binns et al., and Auvray et al. wrote good summary papers, and other brief chapters comain helpful ref-

Part 3 has one chapter, Spinifex-Textured Komatiites: A Review of Textures, Mineral Compositions and Layering, by C. H. Donald

Donaldson's excellent, well-illustrated paper summarizes the physical and chemical characteristics of the most striking aspects of komatiites: their spinifes textures and the well-developed mineralogical and chemical ering exhibited by individual flow units

Part 4 (Alteration and Metamorphism) illustrates the difficulties that accompany textural and geochemical studies of komatites In the first chapter of part 4, W. T. Jolly dis cusses the metamorphism in the Abitibi belt that altered the komatiites and related rocks Beaty and Taylor's companion article deals well with oxygen isotope variation in koma-

The volume's substance lies in part 5; five papers use komatite geochemistry to attemp to describe the Archean mande and the evelution of ultramatic magmas, Beswick examines chemical variations from classic koma localities and ofters several useful techniques for examining original magmatic variation highly altered komatine suites. In an excellent chapter, Smith and Erlank suggest the possibility that different komatite lineages exist and discuss the heterogeneity of so and the changes in magnatic processes with time. A good summary chapter by Findler shows the usefulness of the Sn/Nd isotopic system in determining the age and evolution of komatiites. Arnelt and Nesbitt give additional information on the origins of tholeith basalts and basaltic komatiites in the we studied Munro Township area.

Although part 6 (Economic Geology) has only three papers, the number of papers in no way reflects on the quality: Naldrett and Campbell discuss the physical and chemical models of komatiite-associated nickel deposits, and Keays explores the use of platint group metals as tools for understanding the origin of magmatic sulfides. Both are excellent papers. Pearton's chapter on the occurrence of Au and Sb mineralization illustrates the widespread, but largely unapprecialed occurrence of quartz-carbonate alteration in mafic and ultramafic rocks and Au deposits.

In the final part, two papers provide interesting reading. Bickle presents three methods of estimating the MgO content of the original erupted liquid and concludes that glassy flow margins are most representative. Flow margins however, are grain alreaded and should gins, however, are easily altered and should

be evaluated carefully.

Nisbet states in the final chapter the iectonic setting of komatilites is still fertile ground for speculation on small factual foundation." Nisbet summarizes aspects of the na ture of the Archean basement, the strength of the lithosphere, and implications of observed stratigraphy; he integrates this with some models which define physical constraints of eruptive processes and produces a number of interesting tectonic speculations.

Terry Klein is with the U.S. Geological Survey, Reston, VA 22092.

Revolution in the Earth Sciences: Advances in the Past Half-Century

Shelby J. Boardman (Ed.), Kendall/Hunt Publishing, Dubuque, Iowa, viii + 385 pp., 1983, \$23.95.

Reviewed by James T. Gutmann

This volume is the proceedings of a symposium held at Carleton College to celebrate the 50th anniversary of its Department of Geology and to honor the founder of that department, Larry Gould, later the president of Carleton and long an internationally prominent figure in the area of polar research. The title of the volume may lead some to anticipate a more comprehensive treatment of the evolution" than its articles provide. However, its stated purpose is to illuminate just how the substantial changes of recent decades came about in each of a wide variety of areas within earth science, in effect providing a set of case studies of the revolution. In this i succeeds admirably.

The dramatic evolution of ideas in geotectonics is not directly treated here; indeed, it would be difficult to say much that is new in doing so. Instead, most of the 31 articles in this paperbound volume focus on developments in specific fields ranging from experimental rock deformation (considered by Tullis and Tullis) to the geology of Antarctica (by Rowley). A noteworthy and distinguishing feature of this collection is that the articles provide lucid reviews at a level accessible to undergraduates. Especially valuable for their concise treatment of major areas are papers on advances in high pressure experimentation (by Bishop), on the development of ideas about Archean tectonics (by Southwick), on current thinking about Precambrian crustal evolution (by Ernst) and on the application of

radiogenic isotopic systems to geochronology and petrogenesis (by Bickford). Similarly, Hanor describes the development of thinking about subsurface sedimentary brines, Carson reviews ideas on sediment deposition and deformation at convergent margins, and Collier discusses the renaissance in invertebrate paleontology. Also present are excellent papers on aspects of geomorphology, hydrogeology, archaeological geology, venusian tectonics, and 11 articles on topics in economic geology and mineral and energy resources. Among the latter, all of which are very clearly written, a paper by Albers on the leadership role of the U.S. Geological Survey in meeting national mineral and energy needs is particular-

This volume is uniformly well edited and illustrated. It honors both Gould and the department, for all its contributing authors are Carleton alumni or faculty. The volume should be in the libraries of all geology departments because of the insights its articles provide concerning the evolution of ideas in so many areas of earth science. From these articles comes a sense of the extent to which major strides forward have depended on technological advances and/or new viewpoint commonly resulting from interdisciplinary studies. Particularly in the case of Antarctica, a third influence must be added: the spirit of international cooperation in scientific research fostered by the man to whom this volume is dedicated, Laurence M. Gould.

lames T. Gutmann is with the Department of Earth and Environmental Sciences, Wesleyan University, Middletown, CT 06457.

Early Proterozoic Geology of the Great Lakes Region

L. G. Medaris, Jr. (Ed.), Mem. 160, Geological Society of America, Boulder, Colo., V1 + 142 pp., 1983, \$28.00.

Reviewed by J. Kalliokoski

Interest in the Precambrian geology of the Great Lakes Region has been growing as documented by a new generation of multi-authored books. Two have been published recently: the volume under review and a companion volume, Geology and Tectonics of the Lake Superior Basin, Mem. 156. The Minnesota Geological Survey has published a regional Precambrian geological map at a scale of 1:1,000,000, and in 2 years' time newer data will appear in a DNAG (Decade of North American Geology) volume on the Precam brian of the conterminous United States. Thus, the papers in the volume under review provide a comprehensive view of the status of geological knowledge as it existed in the

In the lead paper P. K. Sims and Z. E. Peterman guide the reader in a few pages through the subtleties of major regional geological features. The Animikie basin developed by faulting and foundering of the general boundary between an Archean granitegreensione terraise on the north and an older Archean gneissic terrane on the south. This basin received sedimentary fill that thickened southward, and, in Michigan, volcanic rocks are intercalated with these sediments in the deeper parts of the basin. In Wisconsin the basin was filled almost entirely by lavas. The intensity of the subsequent Penokean orogeny (1,880-1,770 m.y.) recorded in the supercrustal and basement rocks, increased southward, and tectonic transport was directed to the north. Sims and Peterman distinguish two parallel geological regions on the south side of the Penokean fold belt, based on differences in structural and metamorphic patterns, but in 1981 they considered both tectonic zones to be part of a single orogen.

G. B. Morey provides details missing from the lead paper. He described the lateral and vertical variations in thickness and lithology of the fill in the western part of the Animikie basin and proposes a tectonic model of extension during sedimentation followed by compression in the succeeding Penokean oroge-

Jeffrey K. Greenburg and Bruce A. Brown make a very strong point in their paper: It is possible to distinguish two lower Proterozoic terranes on the basis of contrasting geological characteristics. In the northern Penokean terrane, mostly in Michigan, tholeitic lavas and gabbro sills occur with sedimentary rocks. In the Penokean volcanic belt, entirely in Wisconsin, the layas are calc-alkaline with many

associated calc-alkalic plutons, but with only minor sedimentary rocks. They conclude that these two contrasting terranes may represent tectnostratigraphic plates that converged along the approximate site of the Niagara

The purported collision zone is analysed by D. K. Larue who recognizes distinct tectonos tratigraphic terranes on either side of the fault. The very complex early Proterozoic style in the southern terrane, south of the Penokean volcanic belt, is documented by R.

Eugene I. Smith reports on four chemically and mineralogically distinct rock suites dated at 1.7 b.y. that may be the only surface expression in the area of a felsic volcanic terrane than can be traced in the subsurface possibly as far as western Arizona. R. H. Dott. Ir., describes the distribution and composition of three similar redbed quartzites, he Baraboo, Sioux, and Barron, that fell into the time span of 1.4-1.7 b.y. He proposes that because of their maturity and great thickness they were deposited along a passive continental margin, and because of the severity of their deformation, there may be a suture zone under northern Iowa and Illinois, In an important new contribution on the origin of iron formations R. W. Oktkangas describes the vertical distribution pattern of characteristic clastic facies in stratigraphic sequences that underlie two major iron formations in the western part of the Animikie bain. He concludes that the iron formations probably were deposited on a subtidal-shelf

The memoir contains an excellent collection of papers that covers the subject quite well. Those who have some knowledge of Lake Superior region geology will recognize quickly that these papers represent major advances in the quality of data and in their interpretation. The introduction of plate tectonic concepts to this Proterozoic terrane is new and has not provided clear solutions to long-standing geologic problems. What it has provided is a fresh perspective on, and appreciation of, these old problems, and an exitement to geological meetings and to the lit-

1. Kalliokoski is with the Department of Geology and Geological Engineering, Michigan Technology University, Houghton, MI 49931

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POSTTIONS AVAILABLE

Scripps Institution of Oceanography/Marine Geophysics. The Scripps Institution of Oceanography invites applications for a tenure track position in solid-earth geophysics/tectonophysics. The level of the appointment will depend on the applicant's qualifications. Candidates will be expected to supervise and conduct research in geophysical studies or tectonophysics with emphasis on the ocean basins and their margins. The position will also involve graduate level teaching and the supervision of graduate student research. Applicants must hold Ph.D. degree and have demonstrated excellence and independence in research in geophysics-tectonophysics. Associate or Professorial level candidates must show evidence of strong research record in their specialevidence of strong research record in their special-zation; Assistant level candidates will be expected to show evidence of their potential through publication record appropriate for their experience and letters of recommendation. Send letter of application including description of research interests, list of publications, resume of teaching experience, and names of at least three references to: Chaiman, Graduate Department, A-008, Scripps Institution of Occanography, University of California, San Diego, La Jolla, CA 32033. Closing date for applications is 1b October 1984. We expect to fill the position in calendar year 1985.

An Equal Opportunity/Affirmative Action Em-loyer, Women and minorities are especially invited

Postdoctoral Research Position/Petrology-Geochemiatry: Northern Illinois University, Department of Geology. Recent Ph.D. recipient is sought for one year position starting in early 1985. Strong analytical background in XRF or plasma spectrometry is preferred. The Department of Geology is in the process of acquiring new, automated XRF and DC plasma spectrometers. The successful candidate will be involved in the development of sample-preparation, analytical, and data-reduction procedures, as well as instruction of other users. Independent or collaborative research will be expected. The Department also has solid- and gas-source mass spectrometers, automated EMP, and excellent computing facilities. Please sond application, resume, and the names of three references to J.H. Berg, Departme of Geology, Northern Illinois University, 15, 1984.

Northern Illinois University. hern Illinois University is an affirmative ac-

Satellite Geodesist. The scientific staff position available I October 1981 at the Massochusetts Intute of Technology, Department of Farth, Atmo-spheric, and Planetary Sciences, in a tederally spor sored long-term program of research in geodesy via radio interferometry with Global Positioning System (GPS) satellites. Candidates must have Ph.D. in ge-odesy, and ability and experience in radio interfer-ometry with satellites, as demonstrated by substanometry with satellites, as demonstrated by substanial publications and reference reports. Expertise in
FORTRAN scientific programming, in statistics, in
the theory of satellite geodesy, and in parameter estimation techniques applicable to large, multi-parameter geodetic problems is essential. Experience
in performing field work and in data processing on
large IBM mainframe amilor small PDI-11 computer systems would be helpful, as would knowledge of
the GPS, geodetic reference systems, and network
adjustments. Strong skills in oral and written presentation of research results are required.

Please send vias, including list of jublications, salary requirements, and references, plus reprints of
imajor publications to:
Professor Charles G. Counselman, 111
c/o L.M. Birchette
Personnel Office, E19-238
M.I.T.

Cambridge, MA 02139
MIT is an affirmative action/equal opportunity

The University of Kansas/Faculty Positions. The University of Kansas, Department of Geology seeks to fill three tenure track positions at the Assistant Professor level to begin in Fall, 1985. The Department and the seeks persons compilied to seeks persons. ment seeks persons committed to academic careers involving teaching, research, and service. Salaries will be determined by qualifications and experience and will be competitive. Candidates should hold the Ph.D. degree in Geological Sciences or have it near completion.

completion.

All positions carry responsibility for teaching at both undergraduate and graduate level, conducting active programs of research and publication, and supervising the research of students. Candidates should expect to teach introductory courses as well as in their specialties. The Department may give preference to those who are qualified physically and by training or experience to teach in our summer field programs and have the capability to use the computer to solve geological problems. field programs and have the capability to use the computer to solve geological problems.

Position 1. Sedimentation, with interests in the in-

Pasition 1. Sedimentation, with Interests in the interface between sedimentary processes and stratigraphy, diagenesis and low-temperature geochemistry, or tectonics. Duties will include teaching courses in stratigraphy, sedimentation, sedimentary geochemistry, or tectonics.

Position 2. Tectonics, with interest in the interface between tectonic processes and sedimentation, inneresting the content of the cont

chemistry, or tectonics,

Position 2. Tectonics, with interest in the interface between tectonic processes and sedimentation, igneous phenomena, or metamorphism. Duties will include teaching courses in structual geology and tectonics or petrology. Candidates with field orientation will be preferred.

Position 3. Geophysics, with interests in seismology, crustal structure, or potential fields. Candidates should expect to interact with a strong group in the Kansas State Geological Survey and coordinate the academic aspects of the program in geophysics. Duties will include teaching courses in geophysics, crustal structure, or tectonics.

Applicants should send a resume, academic transcripts, and at least three letters of recommendation to: M.E. Blekford, Chairman of Search Committee, Department of Geology, University of Kansas, Lawrence, Kansas 66045–2124. Application materials must be received by 5:00 p.m. November 19, 1984. The positions are contingent upon availability of funds.

runds.

The University of Kansas is an AA/EEO employer and encourages applications from all qualified per-

University of Texas at Austin. The Department tions effective hall 1985 in one or more of the fol-lowing disciplines: 1) inferepaleoniology, fertiars biostratigraphy, 2) structure-tectonics, 3) hydrogeod-ogy, and 4) mineralogy-kinetics. Each person is ex-pected to teach both undergraduate and graduate courses and to conduct a vigorous research pro-gram, including the supervision of graduate stu-dents, in the area of his or her speciality. The posi-tions require the Ph.D. degree, Applicants should submit a detailed resume, names and addresses of five references, a statement of teaching and re-search interests, and a copy of their dissertation ab-stract by December 1, 1984 to; Dr. William L. Fish-er, Department of Geological Sciences, the Universi-ty of Texas at Austin, Austin, Texas 78713—7909. The University is an equal opportunity/affirma-tive action employer. ons effective fall 1985 in one or more of the fol-

Senior Level Hydrogeologist. Requirements: M.S. + 5 years experience as Project Manager. Computer modeling and writing skills imperative. Strong background in applied hydrogeology integrated with chemistry and engineering desirable.

Remuneration: Commensurate with experience plus excellent benefits and growth potential.

Remmention: Commensurate with experience plus excellent benefits and growth potential.

Respond: In confidence stating interest, full resume, references and salary history to Mrs. V.L.

Borsos, R.E. Wright Associates, Inc., 3240 Schoolhouse Road, Middletown, PA 17057.

Stanford University/Plasma Physics, EM Waves, Space Physics. We are seeking a senior person who has demonstrated scientific, managerial, and leadership qualifications in one or more of the following disciplines: Space Plasma Physics, electromagnetic waves, and solar-terrestrial physics. We expect the successful candidate to have established an outstanding reputation documentable through professional writings or other evidence of personal technical creativity, letters of reference from recognized research leaders in the disciplines mentioned above, and/or awards and other recognition from appropriate professional societies. iate professional societies.

appropriate professional societies.

It is expected that this individual will develop a research program in one of the disciplines given above working in coordination with ongoing programs within the STAR Laboratory and, possibly, with other activities within the Stanford Center for Space Science and Astrophysics. It is expected that this individual will have a strong background in experimental techniques, either in the laboratory or in the lield, including the environment of apace; experimental activities in either laboratory or apace plasma physics would be regarded as good qualifications. However, close association with theoretical developments in plasma physics and/or electromagnetic theory will clearly be desired. It is also expected that the individual will have a demonstrated capability for securing federal or other research grant sup-

that the individual will have a demonstrated capability for securing federal or other research grant support, or be deemed by the selection committee of being capable of securing such funds.

It is anticipated that the person chosen will devote the major part of his or her time to research activities. However, there is an opportunity for participation in academic responsibilities of Electrical Engineering Department, including, when time permits, teaching graduate and undergraduate classes, serving on various committees of the department, School of Engineering, and the University. It is expected that the person chosen will participate actively in the training of graduate students.

The Chairman of the selection committee for this position is Professor Robert A. Helliwell, Professor of Electrical Engineering, Space, Telecommunications, and Radioscience Laboratory, Stanford University, Stanford, CA 94305. Other members of the selection committee include Professor P.M. Banks,

selection commutee include Professor L.R.O. Storey, and Professor L. Tyler.

University of Southern California/Development Technician. A candidate is sought for a marrie oriented electronics technicism position. The suc cessful candidate should be familiar with standard uteroprocessor based occarugatiphic distributional have some familiarity with related deplorment, maintenance, and calibration practices. FOR-TRAN and/or BASIC programming experience is desirable, but not mandators. The candidate should be willing to spend 4-8 weeks at sea per year. Salarrange is \$20 -\$30K depending upon experience and qualifications.

Inquiries may be made to either Dr. Ahm Bratikovich or Dr. Tom Dickey. Ocean Physics Group, Department of Geological Sciences, SCI 167B, University of Southern California, Los Angeles, CA 90089-0741. (Telephone: 213-743-5478 ur 213-743-8367).

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Soli Scientist: Career Federal Service. The Agricultural Research Service U. S. Salinity Laboratory, in Riverside, California, has a position available for a scientist interested in conducting theoretical research of the terraphoral of the programment of the p a scientist interested in conducting incoretical research on the transport of water and dissolved substances through soils. Research should result in a set of models that describe the behavior of salts and water in soil systems. Most have knowledge of advanced soil physics, soil chemistry, and soil-water-plant relations. Salary based on qualifications and experience. GS-11/12/13, \$25,489/\$36,327. Applicants part by 115. Gildens Economic Processing cants must be U.S. citizens. For application procedures call Rita Millard in Beltsville, Maryland, on 301-344-3138.

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EARTH SCIENCES

The Lamont-Doherry Geological Observatory of Columbia University invites recent Ph.D. recipients or candidates for their degree in 1985 in any field of the earth sciences to apply for postdoctoral fellowships awarded for a period of one year (extendable to two years, in special instances) beginning in September 1985 with a stipend of \$26,000 per

Completed applications are to be returned by January 15, 1985. Application forms may be obtained by writing to the Director, Lamont-Doherty Geological Observatory, Palisades, New York 10964. Award announcements will be made on or. about February 28, 1985.

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Associate Chief Space Data & Computing Division

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National Space Science Data Center

NASA/Goddard Space Flight Center is seeking a highly qualified individual to head the National Space Science Data Center (NSSDC). The position is for Associate Chief of the Space Data and Computing Division within the Space and Earth Sciences Directorate. The NSSDC is the principal scientific data center for NASA and operates World Data Center A for rockets and satellites. This center serves as the permanent scientific space data archive and dissemination center and is responsible for the development, management, and operation of specialized data base systems for NASA. Particular disciplinary emphasis is in solar-terrestrial physics and astrophysics. The center develops advanced data base management systems using leading technologies such as high speed mass storage retrieval systems, data base machines and expert systems. The staff consists of approximately 30 civil servants and 100 contractor personnel. The NSSDC operates an expanding computing system currently consisting of a VAX 11/780 and a MODCOMP IV/25 and will have high-speed link to an 1BM 3081, a Cyber 205, and a cluster of VAX processors. NSSDC responds to world-wide requests for documentation, data services, and digital and photographic data. As Associate Chief, the incumbent will also participate in formulating the research policy and long-term direction of the Division. The position calls for both technical and managerial leadership of the organization. The appointment is at the GM-15 level, which curries a salary range of \$50,495-\$65,642.

Qualifications: Goddard is seeking a respected and visionary scientist willing to play a strong leadership role at a challenging time. Applicants should possess a Ph.D. or the equivalent experience in one of the following: a space or earth science-related discipline, computer science, or mathematics. Experience of at least 10 years, with increasing responsibility and stature, including management of a substantive technical group. Applicant should have been closely involved with advanced research utilizing scientific satellite data including data management and analysis and experienced in modern computer systems, technology, and telecommunications. In addition, applicant should have a broad understanding of the science areas in which NSSDC is involved.

licants: Applicants should submit a curriculum vitae, a list of publications, and Office of Personnel and Management Standard Form 171 (Personal Qualifications Statement) to Dr. Franklin D. Martin, Director of Space and Earth Sciences, Code 600, NASA/Goddard Space Flight Center, Greenbelt, Maryland 20771. Selection will be made by the Director of Goddard Space Flight Center, with the aid of a search committee of recognized experts in appropriate disciplines. Deadline for apnlications is October 15, 1984.

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MARINE **GEOTHERMAL** RESEARCH

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Applications are invited for a staff position in a geothermal research group in the Department of Geology and Geophysics, Woods Hole Oceanographic Institution. Ongoing research includes field programs and modelling of oceanic hot spots, hydrothermal circulation, continental rifting, and development of passive continental margins. Opportunities for participation in the MIT - WHOI Joint education program are available.

Qualifications include a Ph.D or equivalent in Geophysics or Earth Sciences, with some experience in marine geo-thermal research. An orientation to field programs and experimentation is preferred, although theoretical/analytical expertise is also desirable. A successful candidate is expected to develop his/her own research programs and support, although some support is available from year. Salary dependent on background

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> Personnel Manager Box 54 P



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Hydrogeologist/Texas A&M University. The Department of Geology and Center for Engineering Geosciences have a tenure track opening, preferably assistant professor level, for which the first search will be for a creative individual working in applied geological hydrollogy.

geological hydrology.

The successful applicant will be expected to develop teaching and research recognition at a national level. The position is available beginning September 1, 1984 and will be held open until filled. Applicants should submit a vita including names of references to M.C. Gilbert, Department of Geology, Texas A&M University, College Station, TX 77845.

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College of Geosciences/University of Oklahoma.

Applications and moninations are invited for the position of Director of the School of Geology and Geophysics. The Director is expected to have a Ph.D. or equivalent, a strong, ongoing research program and administrative experience; industrial experience helpful; field of geological specialization open; to begin July I, 1985; salary to be negotiated. In 1988, the School will move into the new 300,000 sa. ft. Energy Center along with other elements of the College of Geosciences; the Oklahoma Geology Survey; and the School of Petroleum and Geological Engineering and the School of Chemical Engineering and Materials Sciences, both from the College of Engineering.

Applications with curiculum vitae, names and addresses of three references, and/or nominations should be sent to:

auld be sent to:
Francis G. Stehli, Dean
College of Geosciences
University of Oklahoma
601 Elm Street, Room 458C
Norman, Ok 780 lg.
Consideration of applications will begin January

The University of Oklahoma is an Equal Oppor

Illinois Department of Energy and Natural Resources/Positions Available. The Illinois Department of Energy and Natural Resources (ENR). Water Survey Division, is developing a Hazardous Waste Research and Information Center (HWRIC). The Center is the focus of hazardous waste research information and industrial assistance in Illinois state government. Its tole is to provide information and technical support to industry, the public and government officials towards a comprehensive hazardous waste management strategy for the state.

DIRECTOR—Responsibilities: The Director will be responsible for the management and implementation of Center activities aided by group leaders in the research, information and technical assistance programs. The Director will report to the Chief of the Illinois State Water Survey and the HWRIC. Governing Board, Initial tasks include: the evaluation of related activities at the State and Federal level, the development of efficient information clearinghouse and industrial assistance programs, supervision of research and facilities planning activities and acting as the principal spokesperson for the vision of research and facilities planning activities and acting as the principal spokesperson for the program. Qualifications: The successful candidate will be an accomplished scientific professional with demonstrated experience in the management of a scientific research or service program. An advanced degree in an appropriate discipline is preferred. Salary of \$40,000 to \$55,000 per year will be commensurate with experience and qualifications.

RESEARCH PROGRAM COORDINATOR—Responsibilities: The Research Program Coordinator

RESEARCH PROGRAM COORDINA I OR—Responsibilities: The Research Program Coordinator will be responsible for the development and implementation of Center research programs directed towards a clear definition of the extent and severity of HW related problems in Illinois. He/she will be well aware of the corresponding environmental and economic consequences of HW management and disposal operations and to pursue both industrial and government sponsorship of research activities. The Coordinator will report to the Director of the Canter, will directly supervise a small staff of research Coordinator will report to the Director of the Can-ter, will directly supervise a small staff of research professionals and direct contract research support (> \$0.5M) activities with internal and external groups. Qualifications: The successful candidate will be an experienced scientist with demonstrated re-search project management skills. An advanced de-gree (Pla.D.) in a relevant crivitonmental discipline in profession. The start contential and \$250,000 to is preferred. The salary range starts at \$30,000 to \$45,000 per year depending upon the needs of the

\$45,000 per year depending upon the needs of the program.

ENGINEER/INDUSTRIAL ASSISTANCE CO-ORDINATOR—Responsibilies: The Coordinator will be an integral part of the management team of the Center, responsible for the development of a comprehensive program of industrial and technical assistance. Initial tasks will include: establishing contact with industry and trade groups involved in HW reduction and alternative treatment programs; preparing reliable procedures for the analysis of malerials flows and auditing to encourage waste reduction, product substitution, process modification and alternatives to HW landfilling. The Coordinator will report directly to the Director of the Center and will be expected to integrate program activities with related research and information efforts. Qualifications: The successful candidate will be an experiencel chemical process or treatment engineer, motivated towards an effective HW management strategy for Illipois industry. He/she will have demonstrated experience in the management of waste research or service programs which addresses environmental and economic constraints effectively. Salary is \$40,000—\$50,000 per annum according to experience and the needs of the program.

TECHNICAL INFORMATION SPECIALIST—Responsibilities: This position will aid in the development

TECHNICAL INFORMATION SPECIALISI—
Responsibilities: This position will aid in the development of a comprehensive hazardous waste information dearinghouse and HW Hotiline in the Cemet. The position involves the collection of published materials on HW issues, as well as technical information for the use of Cemet research and technical assistance staff. Initial tasks also include the development of a bibliographic data base on HW and the preparation of issue papers for the public and legislature on various issues related to HW management. The position is under the direct supervision of the Information Program Coordinator. Qualifications: The successful candidate should have experience in the data management and information transfer activities of a high level scientific group. Technical writing and communications skills are essential. A degree in library, computer science, or closely related discipline is required. The salary range is \$20,000—\$25,000 per annum, negotiable according to experience.

to experience.
INFORMATION PROGRAM COORDINA-INFORMATION PROGRAM COORDINATOR—Reponsibilities: The Coordinator will be responsible for the planning and huplementation of
HW information clearing house and data base development activities of the Center. He/she will report
to the Director and actively cooperate will the staff
of the research and technical assistance programs.
The successful candidate will supervise the information and data management activities of the Center.
Qualifications: Familiarity and experience with hibliographic, information transfer and computer-aided
reference needs of an advanced scientific group are
easential. Microcomputer literacy would be useful.
Technical writing and issue analysis experience. Salatylevel for this position is \$24,000—\$28,000 per
annum, negotiable according to experience.

RESEARCH SCIENTIST (2)—Responsibilities:
Appplications are sought to fill two research positions in support of HWRIG problem assessment and
problem solving research activities. Each position is
under the direct supervision of the Research Program
Coordinator, Initial tasks will include an assessment
of the extent, magnitude and areal concentration of

Coordinator, rigital tasks will include an assessment of the extent, magnitude and areal concentration of HW generation, treatment and disposal activities in Illinois with an emphasis on environmental and economic impacts. Industrial, economic and environmental and experience of the extension of the environmental and environmental forms. sources to provide an overview and assess the status of research fludings in diverse scientific research efforts in the U.S., of HW related problems towards the development of an effective waste management strategy. In-depth assessments of major waste streams, disputed and teachers assessments. stancy; in-ttepth assessments of major waste streams, disposal and treatment practices in regional to local settings will be conducted to better assess the research and technical needs of the state. This will entail the development of relational data bases to integrate existing regulatory and natural resource data pertaining to waste management activity in the pass, present and the future.

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existing regulatory and natural resource data pertaining to waste management activity in the past, present and the future.

Qualifications: It is anticipated that cach candidate will have at least three years experience industrial geological specialization salary to be negotiated ove into the new are along with other elevaciences; the Oklahoma hool of Petroleum and it he School of Chemical Sciences, both from the my vitae, names and eas, and/or nominations

Stehli, Dean Geosciences of Oklahoma et, Room 458C of Nation will begin January and natural resource data pertaining to waste management activity in the past, present and the future.

Qualifications: It is anticipated that cach candidate will have at least three years experience in abasic science (hydrology, chemistry) or engineering do cach candidate will have at least three years experience and an advanced degree (M.S. preferred) in a basic science (hydrology, chemistry) or engineering cach candidate will have at least three years experience and an advanced degree (M.S. preferred) in a basic science (hydrology, chemistry) or engineering cach candidate will have at least three years experience and an advanced degree (M.S. preferred) in a basic science (hydrology, chemistry) or engineering cach candidate will have at least three years experience and an advanced degree (M.S. preferred) in a basic science (hydrology, chemistry) or engineering cach candidate will have at least three years experience in scientific and engineering data basic science (hydrology, chemistry) or engineering cach candidate will have at least three years experience in scientific and engineering data basic science (hydrology, chemistry) or engineering cach candidate will have at least three years experience in scientific and engineering data waste management and experience in scientific and engineering data basic science (hydrology, chemistry) or engineering cach candidate will have at least three years experience in scientific and engineering data basic science (hydrology, chemistry) o

landfilling. The successful candulate will develop materials thrw estimates, self-audit and direct animates are procedures, as well as an updated data base on Illinois' HAV generation in competation with Center research and information core stall. Quilipation: Proven experience in the design and implementation of wave treatment or process engineering schemes are preferred. Excellent communications and writing skills are essential. An advanced degree in civil, chemical or engineering, or a closely related discipline, is required. Salary range is \$35,000—\$40,000 per year, negotiable according to experience.

experience.
APPLICATIONS: Qualified applicants should submit their resumes and three letters of reference

to:
Stauley A. Changnon, J. . Chief
Illinois State Water Survey
P.O. Box 5050, Station A
Changerign, H. 61820.
CLOSING DATE: November 30, 1984.
The State of Illinois by an equal opportunity/affirmative action employer.

Geophysicist/University of North Carolina. The Department of Geology invites applications for a tenure track for thy position in solid-earth geophysics beginning July 1, 1985. The position probably will be at the assistant professor level, but candidates at the assistant professor level, but candidates at the assistant professor level will be considered. The Ph.D. is required, and post-doctoral experience is desired. Our preference is for a seismologist and/or tectomophysiciat, who would complement current departmental activities, but any good applicant in geophysics will be considered.

Faculty members are expected to conduct a viable and active recarch program, reach graduate and undergraduate students, and supervise theses.

Inquiries and letters of application should be sent of P. Geoffrey Friss, Department of Geology 029A, University of North Carolina, Chapel Hill, NC 27514. Applications must include resume, statement of research and teaching interests, and the names of at least three references. Closing date for applications is October 19, 1984.

UNC is an athrinative action/equal opportunity employer.

Head/Department of Geosciences. The Pennsylvania State University seeks an academic leader to serve as Professor and Head of a large department with 35 faculty members divided among three academic programs: Geochemistry-Mineralogy, Geology and Geophysics.

A decrease degree, significant publications and

gy and Geophysics.

A doctor's degree, significant publications and high scholarly standling are required; administrative experience is highly desirable.

Applications will be accepted until October 15, 1984. Applicants should submit a letter of interest and curriculum vitae to:

Armiff Muan, Chairman

GSc Search Committee
415 Walker Building
University Park, PA 16802.
The Pennsylvania State University is an equal op-portunity/affirmative action employer.

Scripps Institution of Oceanography/Geochemis-try. Applications are invited for a femure tack faculty position in the general field of geochemism and periodogy, including imarganic/physical marine chemistry, marine biogens bemistry, geochemistry of chemistry, marine biogens hemistry, geochemistry of sedimentary, metantor phic, and igneous rocks, flu-id-rock interactions, theoretical and experimental petrology, and organic geochemistry. The position will involve graduate-level to a hing and the super-sion of graduate student research. The level of the appointment will depend on the applicant's qualif-cations. Applicants must hold Ph.D. degree and have demonstrated excellence and independence in research. Associate or prodessorial level candidates must demonstrate a strong research record in heir research. Associate or professorial level candidates must demonstrate a strong research record in their specialization; assistant level candidates will be expected to show evidence of their potential through publication record appropriate for their experience and letters of recommendation. Send letters of application and curriculum viate, including description of research interest, and names of three references to: Chairman, Graduate Department, A-008. Scripps Institution of Oceaning apply, University of California, San Diego, La Joha, CA 92993, Closing date for applications is 1 November 1984.

An equal opportunity/athrmative action employer.

Academic Administrator/Assistant or Associate Re-Academic Administrator/Assistant of Academic Administrator/Assistant of Oceanography has an opening for a split-position of Oceanography has an opening for a split-position- 50% Academic Administrator/50% Assistant/Associate Research Oceanography

isirator/305; Assistant/Associate Research Creangrapher.

The Center conducts a wide variety of field, laboratory and theoretical work in waves, currents,
shore processes, mechanics of nearshore sediment
transport, estuarine processes, continental shelf and
marginal seas research.

The successful candidate will have a PhD in physical occanon apply or coastal selences. The level of
appointment will be determined by experience and
level of independence in his/her field as evidenced
by reviewed publication record in the scientific literature and research record. The ability and desire
for interaction with a variety of people within and
outside the University, particularly funding agencies, are essential. Knowledge of a broad spectum
of research areas is also essential. Some understanding of administrative Issues, e.e. personnel and budgets, is essential.

ing of administrative issues, e.e. personnering of administrator portion of the position is permanently state-funded. The Research portion will be funded by the Center for 12–18 months to enable the candidate to later obtain contract/grant funding either separately or in conperation with other department researchers.

other department researchers.

Send resumes, including areas of research interest and list of publications, with three letters of reference by 31 October 1984 to:

Dr. Douglas L. Inman, Director Center for Coastal Studies, A-009 Scripps Institution of Oceanography.

University of California-San Diego

La Jolla, CA 92098.

UCSD is an Equal Opportunity/Affirmative Action Employer.

tion Employer.

Monash University, Victoria, Australia: Department of Earth Sciences Continuing & Fixed-term (3 Year) Lectureships/Senior Lectureships in Geophysics. Commencing early 1985. One position for a scientist with research expertise in any of the oretical seismology, solid Earth geophysics, tectonophysics, geodynamics, or exploration geophysics, and one position for a scientist with demonstrated research ability in exploration seismology. Possible extension of fixed-term position to fyears. Appointees to establish research programmes involving industry and government support, develop an undergraduate and graduate program coering applied and theoretical geophysics, and supervise. Master's and Ph.D. students, Applicants with experise in thermoment with strong interest in mechanisms of environment with experiment in modelling will find an environment with experiment in modelling will find an environment with experiment in mode

The University of Connecticut is expanding its program in Marine Sciences and seeks qualified candidates for the following positions. All positions require a Ph.D.



DIRECTOR Marine Sciences Institute

DIRECTOR National Undersea Research Program

DIRECTOR Connecticut Sea Grant Program

Apply by November 11, 1984 to:

Alexandra Van Gelder UNIVERSITY OF CONNECTICUT Research Foundation Box U-133 **Storrs, CT 06268** 203-486-3337.

(Search 4G119, 4G125, 4G128) AA/EOE

PHYSICAL **OCEANOGRAPHER** Program Manager

Science Applications International Corporation (formerly Science Applications, Inc.—SAI), a large, employee-owned research contractor for the government and private industry, has an opening for a senior scientist with a background in physical oceanography or a closely related area. Primary responsibilities of the successful applicant will be to manage a major field measurement and data synthesis program involving principal invesligators for SAIC and several leading oceanographic institutions, and to participate in business development in the areas of ocean science and engineering. Applicants should have a Ph.D. and at least six years post-doctorate experience. Expected salary level is commensurate with qualifications and experience.

For more information, please con-

Dr. Paul Debrule Science Applications International Corporation P.O. Box 509 Newport, Rhode Island 02840

Telephone: (401) 847-4210

SAIC is an equal opportunity employer.

t Professor/Atmospheric Sciences. ure track assistant professor position will be available in the fall of 1985 at the University of Kansas ure track assistant professor position will be available in the fall of 1985 at the University of Kansas. Applicants for this position must have a Ph.D. in meteorology or atmospheric science, capability and interest in teaching synoptic meteorology at the advanced undergraduate level, and a strong interest and potential for developing an active research program. Preferred qualifications include postdoctoral research experience and a strong publication record. Duties of this position will include teaching undergraduate meteorology in a B.S. degree program, conducting a vigorous research program, and participating in the responsibilities of the Department of Physics and Astronomy, Salary will depend upon qualifications. Qualified applicants are invited to submit resumes or curricula vitae, bibliographics, narrative statements of research and teaching interests, and the names, addresses, and telephone numbers of three references to Professor I.P. Davidson, Chairman, Department of Physics and Astronomy, University of Kansas, Lawrence, KS 66045. The closing date is November 15, 1984.

An affirmative action/equal opportunity employer, Applications are sought from all qualified people regardless of race, religion, color, sex, disability, veteran status, national origin, age or ancestry.

Project Associate/Specialist: Electron Micro-Probe Lab, University of Wisconsin-Madison. Strong analytical background in quantitative EMP analysis and familiarity with computers is required. The Lab has a 9-spectrometer ARL SEMQ and a JEOLCO 50-A SEM. Dutles will include inatrument maintenance, instruction of students, development of procedures and analysis. Research will be encouraged.

A MS or PhD is required in Earth Science, Chemistry, Physics or Engineering, Minimum salary will be \$18,000/12 mounts with an MS. Send letter of application, transcripts, resume, and names and addresses of three references by September 15 to Dr. John W. Valley, Department of Geology & Geophysics, Weeks Hall, University of Wisconsin, Madison, WI 53706.

An equal opportunity employer.

An equal opportunity employer.

University of Utah: Structual Geology/Tectonics/
Tectonophysics. The Department of Geology and Geophysics at the University of Utah seeks applications for a tenure track position in structural geology, tectonics or tectonophysics. It is anticipated that this position will be filled at the assistant professor level, but applications by more senior persons will be tonsidered. The position requires a Ph.D. with emphasis in structural geology, regional tectonics or tectonophysics. The new faculty member will have the opportunity to teach in the area of his or het specialty and may also be assigned introductory level courses. The successful candidate will be expected to establish a vigorous research program involving graduate students. The person who fills this position will join an active program in structural geology and tectonics that includes both field projects and integrated geology/geophysics ans mechanics/fluid chemistry studies of structures in the western Cordillera. There is an excellent opportunity to tollaborate with other faculty in structural geology, sedimentology, geophysics, geochemistry and petrology. A vita, copies of publications, names of three persons that may provide references, and a letter outlining the candidate's research and teaching interests should be sent to Dr. William P. Nash, Chairman, Department of Geology and Geophysics, University of Utah, Salt Lake City, Utah 84112–1183. Deadline for receipt of applications is December 31, 1984 with the appointment starting in September 1985

The University of Usah is an equal opportunity/

MARINE CHEMIST

The Chemistry Department of the Woods

Hole Oceanographic Institution plans to make a tenure track appointment as Assistant Scientist and invites applications from reseachers with interest in the field of Marine Chemistry. Applicants doctoral experience with a demonstrated interest in natural systems and strong basic physical, organic or analytical chemistry background to study chemica mcesses in marine systems. Experience with techniques in reaction kinetics and mass spectrometry would be particular valuable. Interested candidates should send resume, transcript, reprints and names of potential referees, to:

> Personnel Manager Box 54 P



WOODS HOLE OCEANOGRAPHIC INSTITUTION Woods Hole, MA 02543 An equal opportunity employer M/P/H Research Geophysicist. The U.S. Geological Survey (USOS), Office of Earthquakes, Volcanues, and Engineering, Branch of Seismology is soliciting interest from exceptionally well-qualified persons with either a record of demonstrated ability or outstanding potential for research in one or more areas of Branch activity. The Branch of Seismology conducts fundamental research in the fields of earthquake prediction, network seismology, crustal structure and volcano seismology. The Branch is particularly interested in a geophysicial with expertise in the field of seismology.

interested in a geophysicist with expertise in the field of seismology.

All interested persons should submit a detailed resume of education, experience, summary of interests and research intentions, and the apprepriate salary level commensurate with experience by 5 Octuber 1984 to:

ber 1984 to:

William Ellsworth
U.S. Geological Survey
Branch of Seismology
345 Middlefield Road, MS-977
Menlo Park, CA 94025.

Should a position become available in the Branch, you will be notified of the competitive Federal employment application requirements.

The U.S. Geological Survey is an Affirmative Action/Equal Opportunity Employer.

Physical Oceanographer/Coastal Engineer. Evans-Hamilton Inc., an oceanographic consulting firm in Washington, D.C. area., has an opening for a physical oceanographer/ocean engineer at the MS or PhD level. Emphasis is in numerical modeling of wind, wave, tides, and currents in estuary and on the shelf and also on solving related coastal engineering problems. Some experience in data acquisition and/or analysis is desirable. Salary is open. Company provides merical and profit sharing plans. Send resume to: Douglas J. Evans, Evans-Hamilton Inc., 954 Humperford Drive, Rockville, MD 20850 or call 301-762-8070.

Department Head of Plant Sciences/University of Nevada Reno. The College of Agriculture, University of Nevada Reno, is seeking applicants for this twelve-mouth tenure track position. The Department has nineteen faculty and conducts teaching, research and extension programs in the areas of agronomy, horticulture and integrated post management. A Ph.D. in a plant science related discipline and evidence of administrative and leadership abilities are required. Closing date for applications is October 15, 1984. The position is available January 1, 1985. Contact Or. Elwood Miller, Chairman, College of Agriculture, UNR, Reno, NV 89557–0004, 702-784-tiil 1.

The University of Nevada Reno is an equal op-

The University of Nevada Reno is an equal op-

Northwestern University/Department of Geological Sciences. Applications are invited for a tenure track position at the assistant professor level from persons who will complement one of the existing departmental research programs in structual geology, tectonics, petrology, or sedimentary geology. Applicants must hold the Ph.D. degree by the time of appointment and demonstrate excellence in or strong potential for independent research in one of these fields. In addition to having a strong research orientation the position will involve teaching at the undergraduate student research. Current departmental facilities include VAX 11/750 computer, fully automated JEOL 733 Microprobe/SEM and high pressure and geochemical laboratories.

Letters of application should be accompanied by a resume that includes a description of research interests and accomplishments and teaching experience, a list of publications, and the names of at least three references. Send to: S.O. Schlanger, Chairman, Department of Geological Sciences, Northwestern University, Evanston, Illinois 60201. Closing date for applications is November 1st, 1984. We expect to fill the position for the fall of 1985.

Northwestern University is an equal opportunity/affirmative action employer.

JPL/Meteorologist. The Jet Propulsion Laboratory, California Institute of Technology, Invites applications for a full-time Meteorologist to work in the field of satellite scatterometry. Candidates should possess a MS Degree in Meteorology and will address topics related to the interpretation and verification of the satellite scatterometer data. The position requires knowledge of mesoscale meteorology, time series analysis, and FORTRAN programming. Please submit resume to Professional Staffing, Department M40.

nt M40. Let Propulsion Laboratory California Institute of Technology 4800 Oak Grove Drive Pasadena, GA 91109. Equal Opportunity Employer M/F.

POSITIONS WANTED

Teaching and/or Research — Geology, Paleontology, Geophysics, Mining and Petroleum Engineering. Extensive practical and teaching experience in the US and abroad. Specialist in resource exploration and development—multibugual with fluem Persian and Turkish. Salary and rank negotiable. Reply to Box 026. American Geophylsical Union, 2000 Florida Avenue, N.W., Washington, D.C. 20009.

<u>Meetinas</u>

Announcements

Extraordinary Floods

October 14-18, 1985 U.S.-China Bilateral Symposium on the Analysis of Extraordinary Flood Events, Nanjing, China. Sponsors: USGS, Bureau of Hydrology of the Ministry of Water Resources and Electric Power of the People's Republic of China, (Marshall E. Moss, Chief, Surface Water Branch, U.S. Geological Survey, 415 National Center, Reston, VA 22092; tel.: 703-860-6837.)

One-page abstracts should be submitted by

The theme of this bilateral symposium is the analysis of extraordinary floods, or floods that are perceived to have a recurrence interval in excess of 50 years. The following topics will be addressed; the detection of historical floods and the uncertainties of their peak discharges and times of occurrence; frequency analysis of annual flood peaks when extraordinary floods are present in systematically gaged flood records and when historic floods are detected; the use of storm data in determining design storms and design floods; mul-tivariate analysis of flood peaks and flood vol-umes in the presence of historic floods and historic storms; detection of trends in flood occurrences in the presence of extraordinary floods; critique of U.S. and PRC guidelines for flood analysis that treat extraordinary floods; comparative case studies of U.S. and PRC flood analyses (three case studies each of U.S. and Chinese design-flood experience). For each of the topics, particular emphasis will be placed on the effects of errors contained in the determination of flood magnitudes. Each of the fifty symposium attendees (equally divided between the two sponsoring nations) will be expected to contribute a pa-

per under one of these topics. study tour of sites where historical floods have been documented in China.

Forested Watersheds

October 15-17, 1984 Symposium on Long-Term Research on Forested Watersheds, Coweeta Hydrologic Laboratory, Franklin, N. C. Sponsors: USDA Forest Service, Southenstern Forest Experiment Station, University of Georgia Institute of Ecology, National Science Foundation, International Union of Forestry Research Organizations, Southern Appalachian Research Resource Management Cooperative (June H. Cooley, Institute of Ecology, University of Georgia, Athens, GA 30602; tel.: 404-542-2968.)

The purpose of the symposium is to summarize and highlight the hydrologic and ecological research on forested ecosystems conducted at the Coweeta Hydrologic Laboratory during the past 50 years. Invited papers will cover topics dealing with basic hydrologic processes and how these processes are altered with management practices; nutrient cycling n both terrestrial and aquatic systems and as-

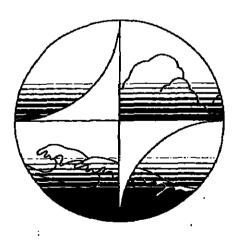
sociated processes; watershed-scale analyses; and the application of research to management needs. Invited poster presentations will describe research in progress, including studies on heavy metal deposition and accumulation, denitrification, analysis of the carbon cycle, and a variety of population studies for terrestrial and aquatic organisms.

In coordination with the symposium, there also will be an open house at Coweeta on October 14, and an all-day technical tour of the lab on October 18.

Continental Crust

Oct. 24-26, 1984 Nature of the Lower Continental Crust, London, England. Spottsors: Geological Society, Royal Astronomical Society, Wegener Foundation. (Geological Society, Burlington House, Piccadilly, London WIV OJU, England.)

This meeting brings together geophysicists. structural geologists, metamorphic petrolo-gists, and geochemists to review current research on the lower continental crust.



Second Circular September 1984

Call for Papers IAMAP/IAPSO Joint Assembly August 5-16, 1985 Honolulu, Hawaii

Sponsors

The IAMAP/IAPSO joint Assembly Is sponsored by the International Association of leteorology and Atmospheric Physics (IA-MAP) and the International Association for the Physical Sciences of the Ocean (IAPSO) of the International Union of Geodesy and Geophysics (IUGG).

Meetings (cont. on p. 696)

Saturday August 11

J5-4 Modeling the Global Ocean/Atmosphere Climate System Special Plenary—Com

Monum Circula tions in Chean and

Dynamics of Misorl Layer

LAMAP Closing Business

1APSO Closing Business Plenary

Friday August 10

JS-4 Modeling the Global

M-2 Long-Range Trans-port and Distribution of Trace Substances Remote Regions M-5 Plantary Boundary

Monsona Carcula-tions in Ocean and

Contective Processes and their Feedback onto the Large-Scale

Monsont Catenda-tions to Ocean and

Convective Processes and their Feedback onto the Large-Scale

Motion Linguistics of the Motions over the Oceans by Measure-ments of Aumospheric Penanus of Mexel Later

EVE

M-7 (Overrum)
O-5 (Overrum)

Timetable

0830^h-1200^h 1330^h-1700^h

1730h-1900h

Cosponsors

We are pleased to have the American Geo-physical Union (AGU) and the American Meteorological Society (AMS) as our hosts, and thereby as the organizers of the Assembly. We also hope to confirm the cosponsorship of the Optical Society of America (OSA) for a

symposium relevant to their interests.

This Assembly continues the excellent cooperation that IAMAP enjoys with the World Meteorological Organization (WMO), which cosponsors the overall Assembly as well as certain symposia of particular interest to WMO. On the occasion of this Assembly, it is our pleasure to join WMO in the organiza-tion of the Fourth WMO Scientific Conference on Weather Modification.

We are looking forward to cosponsorship of the Nowcasting IIa symposium by the European Space Agency (ESA). Cosponsorship of the European Geophysical Society (EGS) is also being sought for certain symposia.
Since this is a IAMAP/IAPSO joint Assem-

bly, it seems only appropriate that the Scien-tific Committee on Ocean Research (SCOR) would be a cosponsor involved in the development of the scientific program from its earliest stages. We are also in the process of requesting cosponsorship from other Interna-tional Council of Scientific Unions (ICSU) bodies for symposia relevant to their interest; these include the Committee on Space Research (COSPAR), the Scientific Committee on Antarctic Research (SCAR), and the United Nations Educational and Cultural Organization (UNESCO).

Introduction

IAMAP and IAPSO last joined forces in an off-year joint scientific assembly in January 1974 in Melbourne, Australia. The rapidly evolving World Climate Research Programme (WCRP) included major programs in both atmospheric and oceanic circulations and forcings, and provided strong motivation to join forces again. Large-scale atmospheric and oceanic processes, and their interactions, form the core of the WCRP. The IAMAP/ IAPSO Joint Assembly will provide an opportunity to assess the scientific status of these processes so crucial to climate, its variability,

and its changes.

The site for the meeting, Honolulu, Hawaii, was selected for the pleasant atmosphere and climate, and the ease in accessibility from around the world.

Housing and Registration Information

Living accommodations for participants are available in the same facility as the Assembly. the Hilton Hawaiian Village. Rooms in this facility are large and contain two beds. The room rates range from US \$74 to \$104; thus, participants have the opportunity to halve their rooming costs by sharing a room with a colleague.

Specific information regarding accommodations and registration will be published in the Third Circular, in January 1985.

Travel Funds

There are limited funds at our disposal for use in assisting participants to attend the Assembly; moreover, spread over all the sympo-sia, there is the capability to help only a very limited number of colleagues for each sympo sium. Participants who need some financial assistance should address their request to the respective convenor who will in turn make a recommendation to the relevant Secretariat of IAPSO or IAMAP.

General

All scientists are invited to participate in the Assembly. Those wishing to present a pa-per should submit an abstract. Deadline for receipt of abstracts-March 15, 1985. This is

Abstract Preparation

Authors are urged to take the utoost care in preparation of their abstracts since there will be no opportunity for correction. The program and abstract book will be prepared by photographing the abstracts exactly as they are received with a 50% reduction for the printed abstract volume. Please use the model abstract to prepare the final version.

The abstract page is divided into two parts: (a) the abstract itself and (b) the submittal information. Follow the instructions for both carefully.

a. The abstract copy must be of letter quality type. Do not exceed the maximum dimensions specified for the abstract (11.8 cm x 18 em); or the abstract will be trimmed to conform to this size.

b. The second part of the abstract page involves the submittal information which must accompany the abstract. Authors must include the following (numbers refer to the items in submittal block on sample abstract): I. title of meeting (IAMAP/IAPSO joint As-

2. corresponding author's address (give complete address and phone number of author Sample Abstract (See explanation)

11.8 cm

NOTE: There are no special forms distributed for typing abstracts. You may trace this form in nonreproducible ink. Please leave at least 4 cm between top edge of paper and abstract title. Type abstract as close as possible to left edge of paper.

INSTRUCTIONS ON PREPARATION OF TYPEWRITTEN COPY

FIRST AUTHOR (School of Oceanography, Hydro University, Watertown, MA 02172) SECOND AUTHOR and ANY AUTHOR (Both at: NCAR, P.O. Box 3000, Boulder) CQ 80307)

Follow these quidelines:

Type title in capital and lower case letters except where all capitals are standard; underscore entire title:

Leave one line blank after title. Type names of authors in all capital letters, with affiliation and address in capital and lower case letters. Do not leave blank lines between authors.

Underscore the name of the author who will present paper.

Leave one blank line after author block. Indent paragraphs two spaces. Do not leave blank lines between paragraphs.

Neatly drawn in symbols, Greek letters or other camera reproducible copy is acceptable. Abstracts must be submitted in the English language, the official language.

1. IAMAP/IAPSO Joint Assembly

2. John E. Scott NCAR Stop 999 P.O. Box 3000 Boulder, CO 80307

3. JS-1

 ∞

ABSTRACT DEADLINE MARCH 15, 1985

Mail Original and two copies to:

Joint Assembly Meeting American Geophysical Union 2000 Florida Avenue, N.W. Washington, D.C. 20009

to whom all correspondence, acknowledgement, and acceptance should 3. indicate symposium code (example JS-1).

Submission of Abstracts

The ORIGINAL plus two copies of the abstract, prepared in the format specified above, should be mailed to Joint Assembly Meeting, American Geophysical Union, 2000 Florida Ave. N.W., Washington, DC 20009 USA by the March 15 abstract deadline date. AGU will forward copies of abstracts to the appropriate convenor(s).

The deadline for receipt of abstracts is firm! Those abstracts not received by the deadline may possibly be included by the convenor in a reserve program, but it is unlikely it will be possible to include them in the program or abstract book. Abstracts containing material outside the scope of IAMAP/IAPSO activities may not be considered. Authors may submit more than one abstract; however, they may not submit the same abstract to more than one symposium. Invited speakers are also required to submit an abstract.

Submission of an abstract is presumed to carry with it permission for AGU to reproduce the abstract in the program and any reports related to this meeting. It is also presumed to permit the free copying of those abstracts; authors are not requested to transfer copyright. Copyright, where it exists, will

Provisional Schedule

This circular includes a provisional schedule for all symposia. The schedule has been arranged to keep conflicts to a minimum. However, some topical conflicts will inevitable

No sessions will be scheduled during the first session of each Joint Symposium or during opening and closing Plenaries. Informa-tion on business sessions will be included in the final schedule, to be distributed with the program and abstract book.

Toint Symposia

JS-1 The Southern Oscillation and El Niño

Lead: IAPSO; Cosponsor: IAMAP (CCL. Convenor: G. Philander (IAPSO), GFDL/

NOAA, Princeton University, P.O. Box 308, Princeton, NJ 08542, USA. Co-Convenor: M. Blackmon (IAMAP/ CCL), ASP/NCAR, P.O. Box 3000, Boulder, CO. 80307, USA.

Papers that describe recent results concerning the following aspects of El Niño and the Southern Oscillation (ENSO) are invited: Observational (oceanographic and meteorological) studies of complete Southern Oscillation cycles, and of the development and decay of warm events; Indian and Atlantic Ocean anomalies associated with ENSO; teleconnections to higher latitudes, north and south: empirical prediction of ENSO; simulation of atmospheric variability associated with anomalous sea surface temperatures in the tropics; simulation of the oceanic variability associated with the Southern Oscillation; air-sea interaction in the tropics.

JS-2 CO2 in the Ocean/Atmosphere System

Lead: IAMAP (CACGP, CCL); Cosponsor:

IAPSO. Convenor: D. Raynaud (IAMAP/CCL), Laboratoire de Glaciologie et Geophysique de l'Environment, Rue Tres-Cloitres 2, B.P. 96, F-38031, Grenoble, Cedex, France. Co-Convenor: Taro Takahashi (IAPSO),

Lamont-Doherty Geological Observatory, Palisades, NY 10964, USA. The role of the oceans as source and sink of atmospheric CO2 will be the central theme. Questions to be addressed include the effects

of oceanic chemistry, biology and circulation on the atmospheric COs, the influence of atmospheric circulation on the CO2 exchange at the ocean-atmosphere interface, the uptake of anthropogenic CO2 by the oceans an role of the ocean in interpreting the past records of the atmospheric ĈOs.

JS-3 Monitoring the Ocean/Atmosphere System-

Lead: IAPSO: Cosponsor: IAMAP (RC). Convenor: M. Hall (IAPSO), NOAA, Code EM-6, 6010 Executive Boulevard, Rockville, MD 20852, USA,

Co-Convenor: J. Harries (IAMAP/RC), Science and Engineering Research Council, Rutherford Appleton Laboratory, Chilton Didcot, Oxfordshire OX11 OQX, United

Kingdom.

The symposium will address emerging observational techniques which hold promise for monitoring of oceanic and atmospheric phenomena on the scales needed for global climate research. Session papers will include satellite instrumentation as well as in situ developments which offer new observational capabilities or unique new ways of making conventional observations. Treatment of air-sea fluxes with combinations of remote and in situ instrumentation is of particular interest. The emphasis will be on techniques which offer efficiencies through their scale of coverage, through inherent integrating properties

(if appropriate for climate research), or ough their remote sampling characteristics. Contributions focused on the needs of emerging programs within the World Climate Research Program (WCRP) will be sought, but discussion of new techniques with broad er application is also encouraged.

JS-4 Modeling the Global Ocean/Atmosphere

Lead: IAMAP (CCL, CDM, CPM); Cosponsor: IAPSO.

Convenor: W. Lawrence Gates (IAMAP/ CDM). Department of Atmospheric Sciences, Oregon State University, Corvallis, OR 97331, USA.

Co-Convenor: Claude Frankignoul (IAPSO), Laboratoire de physique et chimie marines, Universite Pierre et Marie Curie, 4. Place Jussieu, Tour 24-25, F-75230, Paris Cedex 05, France.

This symposium will focus on the design, calibration, and application of both simplified dynamical models and comprehensive models (GCMs) for the coupled global ocean/aumosphere climate system. Papers are invited for sessions on: the parameterization of physical processes in the coupled system, such as the heat and momentum fluxes in the oceanic and atmospheric surface boundary layers, and the treatment of sea ice; the sensitivity of the climate in oceanic and/or atmospheric models to variations in surface forcing, and and analysis of seasonal, interannual and dec adal variations in both the ocean and atmosphere, including the surface heat budget in both low and high latitudes, the monsoons and low-high latitude teleconnections; the use of coupled of coupled ocean/atmosphere models in estimating the climate's response to both natural and anthropogenic factors such as aerosol dust loading and CO2 concentration.

JS-5 Heat Transports; Heat and Water Budgets

Lead: IAPSO: Cosponsor(s): IAMAP (CCL CDM, RC).

Convenor: Fred Dobson (IAPSO), Ocean Circulation Division, Atlantic Oceanographic Laboratory, Bedford Institute of Oceanography, P.O. Box 1006, Dartmouth, Nova Scotta, B29 4A2 Canada.

Co-Convenor: Tomio Asai (IAMAP/CCL, CDM), Ocean Research Institute, Univers of Tokyo, 1-15-1, Minamidai, Nakano-ku,

Tokyo 164, Japan.

This symposium will have as its central theme the elucidation of mechanisms by which meridional transports of heat and salid moisture in the ocean and atmosphere are accomplished on a global scale. Theoretical numerical and experimental contributions are invited which investigate the physical processes involved, the size of the transport, and their distribution in space and time. Of particular interest will be attempts by meteorologists to obtain realistic estimates of the atmopheric divergences of the fluxes of heat and moisture over oceans and continents, by airsea interaction specialists to improve (and prove) the accuracy of oceanic averages of the surface fluxes, by oceanographers to investigate the partitioning of the oceanic fluxes of heat and salt between the gyral and overturning circulations, and by numerical modelers to allow for interactive coupling of ocean and atmosphere.

Monday August 6

Variability of Aerosol M-15 Optical Properties Physical and Chemical M-4 Structure of the Ocean

Sunday Augus 12

AM WMO Fourth WMO Scien-tific Conference on Weather Modifica-

PM WMO Sourch WMO Scient-ulic Conference on Weather Modifica-

Sessions will be focused on presenting a co-herent dynamical description of mid-latitude

ocean variability having timescales of a few

days to a few years. Specific topics include, but are not limited to, the geographical distri

bution of synoptic and planetary scale vari-ability in the ocean; optimal sampling strate-

gies for mapping low frequency oceanic mo-tion; the role of local and remote generating

dies and the mean flow between the mixed

encouraged are observational, theoretical, and numerical modeling studies which offer

dynamical interpretations of observed low frequency motions in mid-latitudes.

of Oceanographic Sciences, Brook Road, Wormely, Goldalming, Surrey, GUS 5UB,

tions which give new insight into the physical processes which affect upper ocean structure,

their parameterization, and regional variab-

lity. Some emphasis will be placed on winter

mixed layer dynamics and the structure of the layer immediately below the mixed layer

which may only occasionally be modified by

O-3 Dynamics of the Mixed Layer

United Kingdom.

surface forcing.

O-1 Variations of Sea Level

layer and the main thermocline. Especially

0.5

M-14 Climate Effects of Nu-

Clear War
O-5 Physical and Chemical
Structure of the Ocean

Monday August 13

Precis Poster Session on Meteorology and Physical Oceanogra-

WMO Fourth WMO Scien-

M-10 Clouds in Planetary

M-12 Polar and Mid-Lati-tude Weather Sys-

Dynamics and Ther O.G

nodynamics and Ther- O-2 modynamics of the

[\$-2] CO₂ in the Ocean/Ar- [\$-5] mustibere System

WMO Jourdi WMO Sien-

CO₂ in the Ocean/At- JS-1 mosphere System

JS-1 Southern Oscillation and El Niño JS-3 Monitoring the Ocean/
Atmosphere System—
New Techniques

Optical Properties try and Climate
M-4 Nowcasting Ha

Nowcasting Ha

Optical Properties

If you and Climate
M-2 Long-Range Transport and Distribution of Trace Substances in Remote Regions

O-1 Formulation of the Main Ocean Thermocline

CO₂ in the Ocean'Ar- JS-! morphere System

Second Week

Precta Power Session on Meteorology and Physical Oceanogra-

Role of Alexica In-teraction in Meye

gions Low Frequency Dynamics in Mid Lauturies

Heat Transports Heat and Water

Role of Air/Sea In-seraction in Meso-wale Development

M-1 (Overrun) M-8 (Overrun) M-8 (Overrun) O-4 (Overrun)

WMO Fourth WMO Scien-tific Conference on Weather Modifica-

M-12 Polar and Mid-Lati-rude Weather Sys-

M-9

tems Comparative China-tology of Terrestrial Planets

Heat Fransports; Heat and Water Budgets

Comparative Clima-tology of Terresimal

WMO Fourth WMO Scen-

IS-6 Monsoon Circulations in Ocean and

Lead: IAMAP (CCL, CDM); Cosponsor: TAPSO.

Convenor: C. P. Chang (IAMAP/CDM), Department of Meteorology, Naval Postgrad-uste School, Code 63, Monterey, CA 93943,

Co-Convenor: Michele Fieux (IAPSO), Laboratoire d'oceanographie physique, 42 rue Cuvier, F-75231 Paris Cedex, France.

This symposium will cover all scales of atmospheric and oceanic motions that are related to the monsoons. For the atmosphere it will include the summer and winter monsoons of Asia, Africa and Australia. It will take into account observational, theoretical, and numerical studies of monsoon structure, development, variability, dynamics, interregional interactions and interactions with other motion systems.

For the ocean it will include all the Indian Ocean processes related to the monsoons, observational, theoretical, and numerical studies of the structure and variability of the ocean circulation, and thermal content, studies on the coupling between the monsoons and the

PS Précis/Poster Session on Meteorology and Physical Oceanography

Cosponsors: IAPSO and IAMAP. Convenors: Eugene LaFond (IAPSO) La-Fond Oceanic Consultants, P.O. Box 7325, San Diego, CA 92107, USA, and Stan Ruttenberg (IAMAP) UCAR Projects Office, P.O. Box 3000, Boulder, CO 80307, USA.

Many types of papers require the ability to display much graphical, alpha-numeric, or pictorial material, too much to show using slides. Furthermore, it is often better in some cases to be able to have one-on-one conversations with colleagues using these display ma-terials. For these kinds of reasons, a Précisi Poster Session will be held during the Assembly for those papers for which such presentations are the most effective way to exchange

Contributed papers covering any aspect of physical oceanography and meteorology are welcome. They will be arranged into unifying topics by the convenors. The authors will give a three to four minute precis talk and will display his/her research on a poster board. In the oral presentation the author can use up to three slides, but there will be no questions following the presentation. Later, the author must stand by his/her poster for a specified half-day to give a detailed explanation and

answer questions regarding his/her paper. Information regarding preparation of posters, including the size of the poster board, will be supplied upon receipt of the abstract. The final schedule for oral presentation and half-day question and answer period will be forwarded to authors by the convenors in May 1985.

IAPSO Symposia

IAPSO Program Committee: K. Wyrtki (USA); K. Hasunuma (Japan); H. Charnock (UK); D. Halpern (USA); A. S. Sarkiysan (USSR); J. D. Woods (FRG).

O-1 Formation of the Main Ocean Thermoclina

Convenor: Juergen Willebrand, Institut für Meereskunde, Düsternbrooker, Weg 20, D-2300 Kiel 1, Federal Republic of Germany. Oceanographic Institute, Wood Hole, MA 02543, USA.

This symposium will offer a forum for the discussion of current research into the processes which maintain and control the formation of the main thermocline. Questions of interest are among others: to what extent are the budgets of vorticity heat and salt (and other tracers) controlled by advective ventilation from the surface as compared to mixing; what are the influences of western boundary currents on the flow structure in the interior of the gyre; and what is the role of seasonal and interannual fluctuations in maintaining the thermocline. Papers are encouraged which deal with theoretical investigations, in cluding those from numerical circulation models, as well as observational studies pertinent to these topics.

O-2 Low Frequency Dynamics in Mid-Latitudes

Co-Convenor; Jens Meincke, Institut für deereskunde, Düsternbrooker Weg 20, D-

2300 Kiel 1, Federal Republic of Cermany.

Convenor: David E. Cartwright, IOS, Bld-ston Observatory, Birkenhead L49 7RA, United Kingdom, Co-Convenor: Johann Lutjeharms, Nation-Convenor: Robert Haney, Department of Meteorology, Naval Postgraduate School, Monterey, CA 93940, USA.

al Research Institute of Oceanography, CSIR, P.O. Box 820, 7600 Stellenbosch, South Afri-This symposium will cover the whole spec-

trum from sub-tidal variations on continental shelves, through annual and interannual variations in tropical oceans, to decade- and longer-scale global trends relative to land level. Emphasis will be on the interpretation of sea level in terms of ocean dynamics and climate change. Contributions on modern tide-guage networks, satellite altimetry and other techniques of space geodesy will also be welcome.

PROVISIONAL SCHEDULE

JS-3 Monitoring the Ocean/ Atmosphere Systems— New Techniques

mechanisms; coastal, equatorial, and bathy-metric influences; the interaction between ed-O-5 Physical and Chemical Structure of the Ocean

Convenor: H. Gote Ostlund, School of Marine and Atmospheric Science, University of Miami, 4600 Rickenbacker Causeway, Miami, FL 93149, USA.

Co-Convenor: Wolfgang Roether, Institüt für Umweltphysik, Universität Heidelberg, IM, Neuenhiemer Feld 366, D-6900 Heidelberg, Federal Republic of Germany.

The symposium will deal with research that Convenor: Raymond T. Pollard, Institute applies the combination of chemical and physical data sets and concepts to the study of oceanic processes on medium and large Co-Convenor: Ian S. F. Jones, Australian Navy Research Laboratory, P.O. Box 706, Darlinghurst, New South Wales 2010, Austra scales in time and space. Included are studies utilizing both steady-state and transient tracers applied to mixing and transport processes in the oceans, modeling of physical and chemical processes, and implications on cli-Parameterizations of mixed layer dynamics mate and bio-geochemistry. Paleoclimatic on all time and space scales remain weak for climatic forecasting. The session will there-fore focus on observations and model simulastudies involving ocean chemistry and physics

O-6 Dynamics and Thermodynamics of the Equatorial Ocean

could also be reported here.

Convenor: Jacques Merle, Office de la Re-cherche de Scientific et Technique Outre-Mer (ORSTOM), 24 Rue Bayard, F-75008 Paris, France.

Co-Convenor: Guan Binxian, Institute of Oceanology, Academia Sinica, 7 Nan Hai Road, Qingdao, People's Republic of China.
This symposium will focus on the physical

mechanisms that determine the motion field and the thermal state of the equatorial oceans. Questions of interest are, among others, the extent of the coupling of dynamical and thermodynamical processes, the processes controling the regions of largest variability and the coupling with the atmosphere. Particular emphasis will be given to time depen-dent processes in the low frequency domain. Studies comparing the similarities and differences among the three oceans are encouraged. Equal emphasis will be given to observational, analytical, theoretical and numerical

WOCE Special Session of the World Ocean Circulation Experiment

Convenor: Francis Bretherton, AAP/ NCAR, P.O. Box 3000, Boulder, CO 80307,

A special session on the World Ocean Circulation Experiment is being organized. Six invited speakers will report on various aspects of this experiment.

IAMAP Symposia

M-1 Atmospheric Chemistry and Climate

Cosponsoring Commissions: CACGP, CCL Convenors: Paul Crutzen, (CACGP), Max-Planck-Institut für Chemie, Postfach 3060, D-6500, Mainz, Federal Republic of Germany, and J. Hansen (CCL), GISS/NASA, 2880 Broadway, New York, NY 10024, USA.

This symposium will cover two interphase areas between atmospheric chemistry and cli-mate variability. 1) Climate relevance of historical and predicted chemical composition. changes of both gases and aerosol in the at-mosphere, and; 2) Climate causes of atmospheric composition changes.

AI-2 Long-Range Transport and Distribution of Trace Substances in Remote Regions

Cosponsoring Commissions: CACGP, CPM. Convenors: R. Delmas (CPM), Laboratoire de Claciologie de CNRS, 2, rue Tres Cloitres, F-38051 Grenoble Cedex, France, and 11. Rodhe (CACCP), Department of Meteorology, University of Stockholm, S-10691 Stockholm. Sweden.

Emphasis will be on the long-range trans-port and deposition of both naturally occur-

Meetings (cont. on p. 698)

Maurice Ewing

Xavier Le Pichon

Medalist:

At my

Meetings (cont. from p. 697)

ring and pollution-derived trace substances in remote tropical, temperate and pular regions and the impact of these fluxes on regional to global-scale atmospheric chemical cycles. Measurements of atmospheric concentrations from which such fluxes can be inferred will also be included. Additional emphasis will be on boundary-layer/ice-surface interactions and on the long-term record of almospheric chemistry and chemical cycles as revealed in

M-3 Clouds and Radiation

Cosponsoring Commissions: CCP, RC,

Convenors: 3A: Andrew Heymsfield (CP), CSD/NCAR, P.O. Box 3000, Boulder, CO 80307, USA, and Garth Paltridge (RC). CSIRO, Division of Atmospheric Sciences, Private Bag No. I, Mordialloc, Victoria 3195,

The effect of clouds on radiative transfer, especially the cirrus problem, and aspects of cloud-typing and improved parameterization by satellite (e.g., ISCCI considerations). Convenors: 3B: L. T. W. Choularton. UMIST, University of Manchester, Sackville Street, Manchester M60 1QD, United Kingdom, and Graham Stephens, CSIRO, Division of Atmospheric Sciences, Private Bag No. 1,

Mordialloc, Victoria 3195, Australia. The effect of radiation on the microphysics and mesometeorology of clouds. Convenor: SC: Alan Arking, Code 915, GSFC/NASA, Greenbelt, MD 20771, USA.

Utilization of earth radiation budget data

M-4 Nowcasting IIa

Cosponsoring Commissions: CCP, CDM,

Convenor: Keith A. Browning (CCP), Meteorological Office, Royal Signals and Radar Establishment, St. Andrews Road, Great Mal-

vern, Worcs. WR14 3PS, United Kingdom. This symposium is intended to be a brief and predominately scientific review of the work reported at Nowcasting II, scheduled to be held at Nortkoping, Sweden, September 1984. It will consist of mostly invited papers.

M-5 Planetary Boundary-Layer Physics

Cosponsoring Commissions: CDM, RC. Convenors: Peter A. Taylor, ARQL (CDM), Atmospheric Environment Service, 4905 Dufferin Street, Downsview, Ontario, M3H 5T4 Canada, and William Large (CDM), AAP/ NCAR, P.O. Box 3000, Boulder, CO 80307,

The symposium will cover a range of topics on the structure and physics of the planetary boundary layer. Papers on the response of the planetary boundary layer to horizontal inhomogenities of the underlying surface such as coastal transition zones and on the effects of orographic or topographic features are especially encouraged, as are papers on the physics of fluxes of moisture, gases, heat and momentum at air-water interfaces.

M-6 Role of Air/Sea Interaction in Mesoscale

Cosponsoring Commissions: CDM, CDM WG A, and CDM WG C.

Convenors: Eric Rasmussen (CDM), Institute of Theoretical Meteorology, University of Copenhagen, Haraldsgade 6, DK-2200 Copenhagen, Denmark, and Gordon A. McBean CDM), Institute of Occan Sciences, P.O. Box 6000, Sidney, British Columbia, V&L 4B2

The exchanges of energy, mass and momentum between the ocean and atmosphere play an important role on all scales of aimospheric energetics. This symposium will deal with the role in mesoscale development, Mesoscale development may occur as convective cloud systems and as structures embedded in larger-scale phenomena. The session will focus on observations and modeling studies that focus on understanding the physical processes and that lead to better parameterizations one session will be devoted to papers resulting from the Storm Transfer and Response Experiment (STREX).

M-7 Convective Processes and their Feedback onto the Large-Scale Motion

Cosponsoring Commissions: CCP, CDM. Convenor: M. Moncrieff (CDM), Atmospheric Physics Group, Imperial College, Blackett Laboratory, Prince Consort Road London SW7 2AZ, United Kingdom.

This session will concentrate on the dynamical aspects of deep convection and the parameterization of convection in large-scale and mesoscale models. Theoretical aspects, numerical models and observational studies will be addressed in order that current progress can be evaluated on a broad basis.

There will be special emphasis on the structure of organized convection and convective systems which are controlled by, or have a direct thermodynamic or dynamic feedback to, the basic flow.

New ideas in parameterization and the verification of schemes against observational data sets and in models will be of particular

M-8 Weather Forecasting in the Tropics

Cosponsoring Commission: CDM. Convenor: Dave Gauntlett (CDM), Bureau of Meteorology, P.O. Box 1289K, Melbourn Victoria 3001, Australia.

This symposium will provide an opportun ty for discussion on the factors which currently determine the practical limits of deterministic weather prediction at low latitudes. Thus emphasis will be placed on issues such as the impact of new observational systems, on four dimensional data assimilation, initial ization and sub-grid scale parameterization techniques. Papers that deal specifically with the predictability of tropical phenomena such as concentrated vortices and line disturbances are also encouraged.

M-9 Comparative Climatology of the Terrestrial

Cosponsoring Commissions: CPAE, CCL. Convenor: Phillip B. James (CPAE), De-partment of Physics, University of Missouri, 8001 Natural Bridge Road, St. Louis, MO 63121, USA.

This symposium will review the current state of knowledge concerning the climate of the terrestrial planets and their evolution. Particular emphasis will be placed upon the climate and volatile history of Mars, including relevant observations and modeling. Attention will also be given to the evolution of the terrestrial atmospheres and to the use of remote sensing techniques to study planets oth-

M-10 Clouds in Planetary Atmospheres

Cosponsoring Commissions: CCP, CPAE,

Convenor: Sushil R. Atreya (CPAE), University of Michigan, 2455 Hayward, Ann Arbor, MI 48109-2143, USA.

Comparative study of the cloud physics of planetary atmospheres, including relationship of planetary clouds to radiation budget, photochemistry, lightning discharges, and atmospheric evolution. Where appropriate, comparison with the terrestrial cloud physics and morphology will be desirable.

M-11 Remote Sensing Over the Polar Regions

Cosponsoring Commissions: CPM, RC. Convenors: Erhardt A. Raschke (RC, SCAR), University of Koln, Kerpener Strasse 13, 5000 Koln 41, Federal Republic of Germany, and R. J. Renard (CPM), Department of Meteorology, Naval Postgraduate School, Monetercy, CA 93943, USA.

The symposium will review current remote sensing techniques including observations from satellites and automatic weather stations and the results obtained, providing an im-proved knowledge of the physical characteristics of the land and ocean surfaces and of the meteorological elements of the polar regions; but will not review data relay or platform lo-

M-12 Polar and Midlatitude Weather Systems

Cosponsoring Commissions: CDM, CPM. Convenors: Dave Bromwich (CPM), Institute of Polar Studies, Ohio State University, Columbus, OH 43210, USA, and S. Tibaldi (CDM), ECMWF, Shinfield Park, Reading. Berkshire RG2 9AX, United Kingdom.

The symposium will examine relationships between the larger-scale weather systems in the polar regions and those at midlatitudes on timescales of days to seasons. The symposium will examine the larger-scale weather systems in polar and middle latitude regions

M-13 Variability of Aerosol Optical Properties

Cosponsoring Commissions: CACGP, CCL,

Convenors: Ardash Deepak, (RC), Institute for Atmospheric Optic and Remote Sensing (IFAORS), P.O. Box P. Hampton, VA 23666. USA, and Robert Dickinson, (CCL), AAP/ NCAR, P.O. Box 3000, Boulder, CO 80307.

Emphasis will be on the following subject: ral variability, and statistics of optical effects in the atmosphere due to aerosols, including radiation transmittance, scattering, and ab-

M-14 Climate Effects of Nuclear War

Cosponsoring Commissions: CACGP, CCL,

Convenors: Barry Pittock (CCL), CSIRO. Division of Atmospheric Science, Private Bag No. 1, Mordialloc, Victoria, 3195, Australia, and Steve Schneider (CCL), ASP/NCAR, P.O. Box 3000, Boulder, CO 80307, USA.

This symposium will deal with the climate/ invitonmental effects of nuclear war, and will include a report of the SCOPE-ENUWAR project. Contributed papers in the following areas will be considered for inclusion:

a. Materials injected into the atmosphere, ncluding papers on fire extent, fuel loadings smoke composition, dust, and gaseous prod-

b. Optical, micro-physical and chemical properties and behavior of injected materials.

c. Mesoscale processes, including plume rise, scavenging, atmospheric disponents in vertical stability, etc.

d. General circulation and climate, including surface temperature, duration of effects, -hemispheric transport, visible and ultra-

violet light intensities. e. Climate impact assessment, including effects on animals, crops, and natural terrestrial and acquatic ecosystems

M-15 Tracing Large-Scale Motions Over the Oceans by Measurements of Atmospheric Electricity

Cosponsoring Commission: CAE. Convenor: Haus Dolezalek, (CAE) Coastal Sciences Program, Office of Naval Research, Arlington, VA 22217, USA.

Tracing atmospheric motions over the sea contributes to the study of air-sea interaction, formation of internal and general boundary layers, energy transfer between air and ocean, and to several remote sensing methods. Aunospheric electricity methods offer some potential not duplicated by other methods (WMO Tech. Note 162): Ions can be traced down to 10 to the minus 17 parts, moving with the air, influencing the easily measured electric field and current density Air-earth current is influenced by air motions aloft. Equipotential surfaces, easily determined, reflect air motions. The purpose of this symposium is to initiate by a small number of papers a discussion on potential and limitation, and on the scope of oceanographic

Joint WMO/IAMAP Symposium

WMO Fourth WMO Scientific Conference on

Program Committee: R. G. Soulage (France), Chairman; F. C. de Almeida (Brazil); I. I. Bertsev (USSR); A. Gagin (Israel); Hitschfeld (Canada); R. L. Lavoie (USA); Ma Peimin (PRC); L. R. Koenig (WMO Secretariat).

Topics of the Symposium:

. Physics of Precipitation Processes . Emerging Techniques of Sensing Microphysical and Dynamical Properties of Clouds

c. Scientific Basis for Evaluating Weather Modification Experiment d. Status of Precipitation Modification and

e. Review of Developments as Reported in

Recent Meetings f. Future of Weather Modification

Potential authors should send an abstract of their contribution to reach WMO by November 15, 1984. The program committee will review these abstracts and notify authors of their decisions regarding the inclusion of their papers in the symposium. Final papers should be four to six pages in length and be prepared in sufficient time to reach WMO by February 15, 1985. These papers will Be published by WMO in a "Proceedings." Abstracts and papers should be sent to: Secretary-General, World Meteorological Organization, Weather Modification Symposium, Case Postale No. 5, CH-1211 Geneva 20, Switzerland.

Related Meetings

The IAMAP Commission on Meteorology of the Upper Atmosphere (ICMUA) will be meeting with the International Association of Geomagnetism and Aeronomy (IAGA) at their Scientific Assembly in Prague, August 1985. For information regarding the IAGA Scientific Assembly, please contact: Mike Gadsden, Secretary-General, IAGA, Department of Natural Philosophy, Aberdeen University, Aberdeen AB9 2UE, United King-

The symposia and workshops which CMUA is cosponsoring and co-organizing are described below. For more information regarding them please contact: Adoph Ebel, cretary, CMUA, Institut für Geophysik und Meteorologie, Universität Köln, D-5000 Köln 41, Federal Republic of Germany.

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Symposium 8: Radiation and Chemistry in the Middle Atmosphere

Sponsors: IAGA, Interdisciplinary Commission on the Middle Atmosphere (ICMA) and IAMAP, International Commission on the Meteorology of the Upper Atmosphere (ICMUA).

Convenor: J. Taubenheim (GDR). Co-convenor: P. C. Simon (Belgium).

8.1 UV Radiances, Cross Sections, Photochem, Modeling 8.2 Solar-Terrestrial Forcing of the

Middle Atmosphere 8.3 High-Latitude Phenomena 8.4 Short-Lived Species in the Middle

8.5 Long-Lived Species including Results of MAP-GLOBUS 8.6 Noctifucent Clouds, including Results of MAP-CAMP

8.7 Interaction of Neutral and Ionized Components of the Middle Atmosphere

Symposium 11: Dynamics and Remote Sensing of the Middle Atmosphe Sponsors: IAMAP, International Commission on the Meteorology of the Upper Atmo-

sphere (ICMUA) and IAGA, Interdisciplinary Commission on the Middle Atmosphere (IČMA).

Convenor: R. G. Roper (USA) (not yet confirmed).

Co-convenor: A. Ebel (FRG). The sessions of Symposium 11 are devoted to the observation, interpretation and modeling of dynamical processes in the middle atmosphere (about 20-110 km height). Coupling of the middle atmosphere with the trothere and higher thermospheric layers will also be discussed. One of the main topks will be momentum and heat transport due to atmospheric waves (gravity, tidal and planetary waves) as well as turbulence (2- and 3-dimensional). Symposium 11 is organized in close cooperation with Symposium 8 (radia-tion and chemistry in the middle atmo-

11.1 Progress in Remote Sensing Techriques from the Ground and from Satel-

11.2 Dynamics of the Stratosphere, including Troposphere Coupling 11.3 Dynamics of the Mesosphere and

Lower Thermosphere 11.4 Circulation Models of the Middle 11.5 Tides, Gravity Waves and Turbu-

11.6 Climatology of the Middle Atmo-11.7 Coupling between Photochemistry

and Transport in the Middle Atmosph 11.8 Winter in Northern Europe includ-ing Results from MAP-WINE

Acronyms

COSPAR Committee on Space Research IAU International Astronomical Union

ICACGP IAMAP Commission on Atmospheric Chemistry and Global Pollution ICAE IAMAP Commission on Atmospheric Electricity

IAMAP Commission on Climate IAMAP Commission on Cloud Physics ICDM IAMAP Commission on Dynamic Meteorology Inter-Union Commission on the Lithosphere

IGMUA 1AMAP Commission on Meteorology of the Upper Atmosphere ICPAE 1AMAP Commission on Planetary Atmospheres and their Evolution

IAMAP Commission on Polar Meleorology International Council of Scientific Unions International Ozone Commission International Radiation Commission

International Union of Geodesy and Geophysics International Association of Geomagnetism and Aeronom International Association of Hydrological Sciences

IAMAP International Association of Meteorology and Atmospheric Physics IAPSO International Association for the Physical Sciences of the Ocean International Association of Volcanology and Chemistry of the Earth's Interior Joint Scientific Committee (for the WCRP, ICSU/WMO)

MAS Middle Atmosphere Sciences
SCOSTEP Scientific Committee on Solar Terrestrial Physics Union Radio Scientique International VIRA , Venus International Reference Atmosphere World Climate Research Programme World Meteorological Organization

11.9 Tides in the Middle Atmosphere Sponsor: ICMUA (IAMAP), Working Group on Tides in the Mesosphere and Low-Chairman: J. M. Forbes (USA).

Middle Atmosphere Workshops

During the two years prior to the ICMUA meeting in Prague the working group will have examined various aspects of deducing tides from data time series, including spectral analyses, filter methods, Fourier fits, and addressing such questions as 'variability' and measures of 'uncertainty' in derived tidal components. Tentative conclusions and recommendations will have been discussed at the Kyoto MAP Symposium in November 1984. One purpose of the 1/2 day workshop at Prague will be to finalize these conclusions and arrange for their publication. A second matter for discussion will be the feasibility and value of developing an observationallybased climatological model of tidal winds and temperatures in the mesosphere and lower

Activity Effects into the Middle Atmo-

Sponsor: ICMUA (IAMAP), Working

11.10 Downward Penetration of Solar

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(FRG). The aim of the workshop is to contribute

(to be confirmed Cochairmen; A. D. Belmont (USA), A. Ebel IAMAP Officers

Group on Solar-Terrestrial Relationships. Cosponsors: SCOSTEP, COSPAR, WMO

to a better understanding of solar-induced changes in the aunosphere through presentaions restricted to less controversial topics in the field of solar-terrestrial relationships. Therefore, it is intended to concentrate mainly on effects observed and/or modeled at middle stratosphere heights and above. Contributions about radiation and particle effects, response mechanisms, solar activity data etc.,

IAPSO Officers

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Citation

Mr. President, fellow members of the American Geophysical Union, and members of the U.S. Navy, it gives me great pleasure to present the citation for the 1984 ACIV • Join AGU and receive Eos every week for the rest of 1984 at no additional charge. Di. Navier Le Pichon. USN Maurice Ewing Medal, to be awarded to

After receiving diplomas in several disci-plines of geology, physics, and geophysics from the University of Strasbourg during the 1950's, Navier came to the Lamont-Doherty Geological Observatory as a visiting scientist where he put his knowledge to practice until 1968, In 1966 he received the Doctor of Sciences degree from the University of Strasbourg, Returning to France in 1968, Navier spent the next live years at the Centre Océanologique de Bretagne in Brest where REGULAR MEMBERS-Individuals who are professionally angaged in or associated with geophysics including college or university students. Students he founded the Research Group, From Brest profiled in at least a half-time program of study leading to a degree receive special reduced dues and journal subscription rates. ASSOCIATES—individuals not he moved to the headquarters of CNFXO in Paris for 5 years and then to the University of Paris to found the new Laboratoire de Geodynamique. From his present position of professor at the university he will move next year to become director of the Geology Labor ratory in the Ecole Normale Supérieure, one of the French Grandes Ecoles There are many examples of Xavier's scien-

tilic accomplishments, and they occupy a very broad spectrum of the marme science disciplines. Author or countries of three books and some 150 other publications, he has been a most prolific producer of experimental and observational results and of new ideas. Among his contribution that I am most familiar with are several papers based on his work at Lamont covering a wide range of studies in seismic, gravity, magnetic, and geothermal methods. During this period he was also a major collaborator in establishing the validity of the plate tectonics story, coauthoring several of the key early papers and producing the first global map of plate boundaries and motions. At the same time he was engaged in a major effort in which he combined physical oceanographic observations and seismic reflection surveys into a coherent picture of bottom water circulation and its large influences on the regional sedimentation patterns of the South Atlantic.

Xavier's continuing interest in the plate tectonics theme has resulted in a large number of significant contributions to the refinement of the global tectonic framework. He has shed considerable light on the tectonic development and evolution of rifted continental margins, within a framework of extension. fracture zones, thermal subsidence and sedimentation, and he has been engaged in a monumental study and geodynamic interpre-tation of the Aegean-Hellenic Arc region of the Mediterranean Sea. A recent addition to his already varied collection of publications, in which he probes more deeply into the earth, is geoid, panges and convection. Another important area of marine research in which Xavier's participation and influence were prominent factors has been the initiation, with Woods Hole, of Project FAMOUS and follow-on promotion of deep submersible milization in a variety of studies of the seafloor. A major program to study the Japanese trenches is scheduled to begin next year with the new French 6000 in submarine.

This very brief listing of some of Xavier's work is not intended as a summary but, rather, as an indication of the breadth of his endeavor in pursuit of a better understanding of the earth. The topics of his publications range from ocean circulation to processes in

· AGU (cont. on p. 700)

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the mantle, from evaporites in the Mediterranean and under continental margins to tec-tonics of back are basins, from subsidence of margins and continental basins to techniques of seismic analysis, from stretching of the lithosphere to avalanching in submarine canyons, from seismic stratigraphy to poles or rotation and continental reconstructions, from fracture zones in mid ocean to the Pyrenees. from seamounts to deep sea trenches. from sediment distribution to analysis of gravity, magnetics and geother mal aurmalies. In very few of these topics have his contribu-tions gone unnoticed. Some have been controversial; a few would probably have been written differently if he had had access to a crystal ball or to hindsight, but it is far more important that he consistently looked for answers to non-trivial questions. In doing so he covered a lot of territory and he has had a great impact on many important areas of marine science during the past two decades. In addition to his own work, he has guided and influenced the research of many of the younger generation of French scientists and has also played a prominent part in developing scientific policy and priorities both at home and abroad. He has served the scientific community on a large number of national and international committees, in which role he is extremely effective by virtue of his scientific provess, a keen and organized mind, and strong motivation.

So, Xavier, it has been a long and productive time for you since the 16th cruise of Vena when, I believe, you began in carnest to get your feet wet, both literally and liguratively, in marine geology and geophysics. You learned quickly, you worked hard and you accomplished much as a scientist and as a scientific stateman. We salute you for your past achievements, and we fully expect that you will reward us with many encores in the fu-

Acceptance

张州。

3

Twenty live years ago, under a Fullbright fellowship, I joined Lamont-Doherty Geological Observatory to specialize in marine geophysics. The first day I met Mantrice Ewing, he told me. "Get on the Vema, she is sailing next week. We need a physical occanographer there." I quickly understood that this was not open to discussion. And this is how I joined the 16th cruise of *Vena* around the world, measuring potential temperatures to trace the path of the deep Indian Ocean Water. But it was during this cruise that the continuity of the mid-occan ridge around the tip of Africa was tested. We were criss-crossing the rift-valley and had to wire back to Doc Ewing in Lamont each time we found the crack at its predicted location. Such was the beginning of my love affair with the Mid-Ocean Ridge which kept me insisting that I wanted to do marine geophysics, not physical oceanography. It was also the beginning of my education to research.

Today is a great opportunity for me to say how grateful I am for these six years at Lamont. How much I learned there about science and about life, especially from Maurice Ewing, John Ewing and Manik Talwani, but also from Marcus Langseth, Jim Heinzler, Bruce Heezen and many others. This was a time of great scientific opportunities in an in tensely living laboratory. I also realize how much I owe to the American research community and its exhilarating high pace of competitive opportunities. I must single out Harry Hess outside of Lamont as one of those who inspired me most.

John Ewing knows how difficult it was for me to decide to go back to France in early 1968, at a time where the plate tectoric revolution was spreading over the whole states. Maurice Ewing could not understand my decision: "Why go back to such an old country?" He told me, "If I were in your position, I would go to Australia". But man has a heart and, fortunately, love of his own country is deeply imprinted on it. Later on, I was impressed by the fact that Duc himself decided to have his last research venture in Texas, his ntry. Back in France, I ha cover through years of struggle that, although science is the same there, research life is ouite different from the American one, different and in a sense complementary. Through the last 15 years, I have seen Euro pean geoscience grow and mature. It seems to me that it is now quite healthy and bubbling with life, conerging as a real partner to American geology and I hope that this Mau-rice Fwing Medal presentation will be another link between American and European geosciences. Finally, it gives me great pleasure that this presentation is made by John Ewing who taught me the basics of marine seismold gy and assured me of his continuing friendship and patient understanding during the 5 vears I spent in his team. Thank you, John.

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Eric L. Butler: Congressional Science Fellow

Eric L. Butler, a chemistry and oceanog-raphy instructor at Phillips Academy in Andover, Mass., has been selected as the 1984-85 AGU Congressional Science Fellow, Last week AGD Congressionan ence Fellow. Last week he began his t-year stint | on Capitol Hill as AGU's eighth Congres-

sional Science Fellow. Butler, a member of AGU's Ocean Sciences section, received his Ph.D. from the Graduate School of Oceanography of the University of Rhode Island. While his formal course work focused on chemistry and oceanography, his research has dealt largely with atmospheric chemistry and the measurement and geochemistry of trace organic compounds. He has been associated with the Center for Atmospheric Chemical Studies at the University of Rhode Island since its inception several years ago, From 1978 to 1983, at URI, he was co-

principal investigator of a National Science Foundation-sponsored grant on methyl iodide and the atmospheric iodine cycle. In recent years he has designed and implemented a system for the collection and quantitative analysis of methyl iodide using capillary gas chromatography. In 1982, Butler conducted atmospheric sampling research on a cruise in the Peruvian upwelling area and on field expeditions to Oahu and Mauna Loa.

While at URI, he was an oceanography in-

structor and a graduate research assistant. Last September he began teaching at Phillips Academy to broaden his teaching experience. Many of the topics that require "congressional concern and action" often "cut across the traditional boundaries of the various scientific disciplines and call for an interdisciplinary perspective," according to Butler. He hopes to apply his interdisciplinary approach to oceanography to his work as a Congressional Science Fellow.

Butler received his B.S. in chemistry, mag-na cum laude, in 1976 from Muhlenberg College in Allentown, Pa.

The AGU Congressional Science Fellow program is one of about 20 professional society programs that make up the American Association for the Advancement of Science (AAAS) Congressional Science and Engineering Fellows program. This program involves scientists and engineers in making public policy within Congress through work on members' staffs, on congressional committee staffs. in some other area of Congress.-BTR

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Exploration Geophysics

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O920 Magnetic and electrical methods
DWDERGROUND DIL-SHALE RETORT MONITORING USING
CEOTOMOGRAPH
William Daily (Lawrence Livermore Mational Laboratory,
University of California, P.O. Box 5504, Livermore, CA
98350)
Geophysical Lomographs (geotomographs) were under of two
underground oil-shale retorts: (1) the Occidents! O()
Shale Inc. miniretort constructed for ignition tests at
the demonstration mine at Logen Wash, Colorado; and (2)
the Geokinetics O() Shale Inc. Recort 23 near Yornal,
Vith. These experiments demonstrate that geotomography
may be a valuable diagnostic tool for underground
oil-shale retorting processes. At the Geokinetics in-satu
retort, the technique dulinested the somes of high
permebality in a crass-section of the retort. At the
Occidental modified in-situ miniratort, the technique
Geological the high-temperature some of the retort with a
spatial resolution of about 2 m, and showed its temporal
development over a period of eleven days.
GEOPHYSICS, VOL. 49, NO. 10

O220 Hagnetic and electrical methods

RECTRICAL MODELING OF THE INDINGEREDUS INVADED ZONE

D. Drabos (Dept. of Geophysics, Ectros Univarity, 1038)

Budspace, Fun Dela ter 2, Hangary)

The ideal rock model in claritical well longing for prospecting hydrocathon cunsists of three cellularical invasion of the constant but chemperature in the dialance from the barchale, this condition could be taken into consideration, but the volution of his region and circumstances the rusisivity is not constant but chemperature.

This condition could be taken into consideration, but the volution of head of the dialance from the barchale, the volution of head of the dialance from the barchale, as very complicated.

Any kind of invasion resistivity profile can be approximated by sany cylindrical layers of homogeneous resistivity slaver made to a study the affect of the homogeneous resistivity and committed the control of the free resistivity increasing sensitivity slaver model of three homogeneous layers. The resistivity profile and control of the free resistivity increasing sensitivity walks. These homogeneous layers. The resistivity profile of the free resistivity increasing sensitivity walks. These homogeneous layers. The resistivity profile of the control of the

MANATSIS OF THE INFLUENCE OF PRACTURE GROWETSY ON MASS TRANSPORT IN FRACTUREN MENIA Lesile Smith (Dept. Geological Sciences, University of Fiftish Columbia, Vancouver, Canada, V67 284), P.V. Schwarp.

Casia Suith (Dept. Ocological Sciences, University of Fittish Councils, Vancouver, Canada, V67 284), P.W. Schwart, Canadia, V67 284, P.W. Schwart, V67 284, P.W. Schwart

3130 Groundwaler A MODEL FOR INVESTIGATING MECHANICAL TRANSPORT IN FRACTURE FLOW NETWORKS

A MODEL FOR INVESTIGATING MECHANICAL TRANSPORT IN FRACTURE FLOW NETWORKS.

A. B. Endo (Earth Sciences Division, Laurence Berkeley, Laboratory, University of California, Berkeley, Ca. 94720] J. C. S. Long, C. R. Hilson and P. A. Mitherspoon A tachnique is presented to determine when anisotropic fracture systems can be rodeled as equivalent provous modia (continua) for transport. In order to use the continuum approach, one mat domonstrate that the fracture system has the same transport behavior as an equivalent porous medium, Hydraulic effective porosity is calculated as the product of specific discharge and specific discharge and hydraulic effective porosity are measured in diffurent directions of flow in regions of varying size with constant Hydraulic effective porosity are measured in diffurent directions of flow in regions of varying size with constant Hydraulic properties: (1) specific discharge can be predicted from a permeability tensor and, (2) Hydraulic effective porosity is independent of direction of flow. A numerical rodel has been developed to simulate mechanical transport under steady flow in a discrete fracture network. The rodel is used to determine the distribution of travel times from inlet to outlot for fluid traveling in streamtubes. He have examined only systems with parallel fracture sets in which all fractures are long compared to the region under study. These systems do not satisfy criterion in that flux can be calculated using a porous redium equivalent. However, these systems do not satisfy criterion 2 because hydraulic effective porosity is shown to be directionally dependent. Thus, even though flux can be accurately predicted using porous redium assumptions for some fracture systems, it ray not be possible to accurately predicted using porous redium assumptions for some fracture systems, it ray not be possible to accurately predicted using porous redium assumptions for some fracture systems, it ray not be possible to accurately predict mechanical transport.

Water Resour. Ros., Paper 4MOSLo.

Geophysical tomographs (geotomographs) were made of two underground oil-shals retorts: (1) the Occidental Oci Shale inc. miniratort constructed for ignition tests at the demonstration wins at Logan Wash, Golorado; and City in the Geolinetics Oil Shale inc. Retort 23 near Vernel, Wish. These caperiments demonstrate that geotomography may be a valuable diagnostic tool far underground all-shale retorting processes. At the Gankinetics. In-all processes, at the Gankinetics of the processes of high perseability in a cross-section of the retort. At the Gankinetics, in-all persential technique of finite difference is persented the high-temperature some of the retort with a spatial resolution of shout 2 m, and showed its temporal sevelopeant ower a period of eleven days.

GEOPHYSICS, VOL. 49, NO. 10

OND Nagnetic and electrical methods

Steven A. Arcone (USA-CREEL, Lyms Road, Hanover, NH)
The propagation of alcotromagnetic pulses in naturally occurring dielectric surface layers has been examined. Faise duration used in field experiments resported here has been on the order of nanoseconds with pulses handwidths in the high VMF to Low UMF band. The layers were sheets of fresh water ice and granite at thicknesses renging between De and Am. Both transverse olectric CTM modes were attempted but only the TE propagation could be interpreted. Amaigner recordings of wide-angle reflected in a continuous graphic diapley. The diaplays allowed easy identification of the saturated flow equation for a small resolution of the pulses. The phase and group vel. oil cape in the continuous graphic diapley. The diaplays allowed easy identification of the surface agree well with the velocities of the several propagation could be interpreted. Amaigner profiles were taken and recorded in a continuous graphic diapley. The diaplays allowed easy identification of the surface agree well with the velocities of the several propagation could be interpreted. Amaigner profiles were taken and recorded in a continuous graphic diapley. The diaplays allowed

waveguide aquation. In one case the Airy phase of wave-packer propagation occurred. The best measure of the deletric constant of the layer was the frequency of the air wave.

GDPHYSICS, VOL. 49, NO. 10

GDPHYSICS, VOL. 49, NO.

resulted in substantial improvements in simulated reservoir operations with derived stationary reservoir operating policies. While these results are for a dam at Assem in the Nile River Busin, operators of other reservoir systems also have switable to them information other than the praceding period's inflow which can be used to develop improved inflow forcests. [Reservoirs, optimization, Stochastic processes, Assem

3199 General Hydrology (Geothermal Reservoir Engineering) THE KRAPLA GEOTHERMAL FIELD, ICELAFO: 3. THE GENERATIFO CEPACITY OF TAE FIELD G. S. Bodwareson (Earth Sciences Division, Lewrence Berkelmy Laboratory, University of California, Berkeley, California, 94720), K. Prusss, V. Stefansson, and E. T.

Water Resour. Red., Paper 4W1042.

3199 General Hydrology (Goothermal Reservoir Engineering THE ERAFLA GEOTHREMAL FIRLD, ICELAND: 2. THE MATURAL STATE OF IRE SYSTEM
G. S. Bodyersson (Earth Sciences Division, Lawrence Berbelay Laboratory, University of California, Herbeley, California, v4770), K. Pruess, V. Stefansson, and E. T.

California, va720) R. Prussa, V. Stafansson, and E. T. Eliasson.

A model of the natural state of the Krafis reasoroir system in iculard has been developed. The model commists of a vertical cross section that includes reservoirs in both old and new wellfields. The physical processes considered include mass transport, conductive and convective best transfer and boiling, and condengation. Hatural heat losses to surface manifestations (aprings) are also included. The model matthes very well all relevant data from the Krafia Held. The natural flow of hot fluids through the reservoirs is estimated at approximately 20 kg/s. Steam escaping to surface springs constitutes the bulk of the heat losses in the area modelad. Conductive heat losses through the captor's are approximately I Wa², and heat vecharge from below is about 2 Wa². (General hydrology, groundwater, thermal properties).

Oceanography

4713 Circulation
VERTICAL STRUCTURE OF IME ZONAL PRESSURE GRADIENT IN
THE LASTERN EQUATORIAL PACIFIC
L. J. Hangum and S. P. Mayes (Pacific Marine Ravironmental Laboratory/ROAA, 7606 Sand Point May NF.
Seattle, Washington, 98155
CTO data from the EPGCS and NORPAK experiments were
used to construct a mean runal pressure gradient
profile between 110°W and 150°W for the 1979 to 1981
pro-El Não Lime ported. The mean zonal pressure
gradient, referenced to 1000 db had a value of -4.5 * 10 7 m s 2 41 the surface and decreased to within two
standard errors of cere at 200 db Below this depth,
the mean was not significantly different from zero.
Deviations from this mean were not related buffictual
tions of the zonally averaged zonal wind stream between
190°W and 10°W. Rather, the largest deviations, in
horsel spring of 1979 and 1980, supeared to be associated with first vertical mode kelvin wave pulses propagating sastward along the equator.
The 1910-81 mean profile was also used as a reference
to rassine variations in zonal pressure gradient during
the 1922/81 RSOS event the sea surface was more
sharply sloped upward from cust to west in April and
Suptember 1983. Refere and near the beginning of the
event. The surface slope was below noreal in April and
October 1983. Vertical profiles of the zonal pressure
gradient deviations showed larger into yesteral mode
contributions during the event than in the pre-event
association.
Leventy and the presevent the pre-event
association and the pressure gradient, El Niño.
Kelvin Mavesi

J. Gronbyn Row. C. Never 2008.

J. Geophys. Ros., C. Paper 401036.

THE SENSITIVITY OF A ONE-DIMENSIONAL THERMODYNAMIC SEA LET MODEL TO CHANGES IN CLOUDINGSS.

P. P. Shame (Department of Accorptoric Physics, Clarindon Lateratory, Onford ONE 1981, U.F.) and R.O. Crame. A thermodynamic sea localed routed in used to manuse the importance of cloud down changes to modelful towards the information of cold four changes to recipions where they receive reseasonal sea toe, the cloud abunit variations have relatively little import. Bowever, for regions where the presence of summer too is variable from your-to-post, the country in general, with a snew covered surface, decreased cloud deals to surface waiting. For a celting late of the defendance, the inverse occurs. The located response time of some covered country and cloud feeds to surface waiting. For a celting late in the surface waiting. explain interapholal variations in ico thickness and cateny. Revertheless, the implication of the results is that numerical modelling of see too distribution requires accurate cloud data or cloud prediction, and that transs in cloud cover are land as similations preturing in a li-

J. Geophys. Res., C. Paper 4C1003.

4760 See ice

A GOUPLED IGE-OCEAN MODEL OF IGE EXEAK-UP

AND BARDING IN THE MARGINAL ICE ZONE

O.K. Seedsted (University of Dalo, Institute
of Geophysics, F.G.Box 1022, Blindern,
N-Oslo 3, Norway) and L.P. Read

A coupled ice-ocean numerical model for the
marginal ice zone is considered. The model
consists of a monlinear sea ice model and a

two layer (reduced gravity) cosen model. The
dependence of the upwelling response on wind
stress direction is discussed. The results
confirm earlier smallytical work. It is shown
that there exist directions for which there
is no upwelling, while other directions
give mainwam upwelling in terms of the
volume of uplifted water. The ice and common is
coupled directly through the stress at the
interface ice cosso. As interesting consequence
of the soupling is found in cases when the ice
edge is almost stationary. In these cases the
ice tends to break up a few tenths of kilomaters
inside of the ice edge. (See ice, ice edge
upwelling, ice break-up).

J. Georbys. Res. C. Paper MC0900

. Geophys. Res., C, Paper 4C0990

SIMILARITY OF THE WIND MAYE SPECTRON IN FINITE BEFTS WATER, PART I - SPECTRAL DY. Resemble | (Max-Planck-Institut für Mateorologie, Bundesstr. 55 - GEOMATIKUM, D-2000 Hamburg I), Federal Rapublic of Germany) and G.L. Vincant. A suffaintier spectral shape (the TWA-spectrum) to describe windwayes in water of fluits depth to presented. The parametric spaceral form is depth depth and and an oxtension of the deep water JONSWAP-spectrum. The behaviour of the spectrum in fraquency and way number special idlacused. About 2800 spectra salested from the three data cats (YZEXL storm, MARSEM, APSLOS) are investigated to show the general validity of the proposed selfsimilar spectral shape. SIMILABITY OF THE WIND WAVE SPECTRON IN FINITE DEPTH WA-

J. Geophys. Res., C. Paper 4C1001

A THREE-DINGSSIONAL ANALYSIS OF MARINE RADAR IMAGES FOR THE DETERMINATION OF OCEAN WAVE DIRECTIONALITY AND SUR-I.R. Young, W. Romenthal (Max-Planck-Institut für Meteo-rologie, Bundsatt. 33 - GEOMATIEUM, 2000 Ramburg 13, Federal Ropublic of Germany), and F. Zisner A time series of photographs from the tadar across of a conventional marine rader is sneatysed to determine the three-dimensional E(kg,ky,v) spectrum. Significant spec-tral energy density is found only in the close vicinity of a shell in k. uspace defined by the disparsion rela-cion. Since corrects influence the disparsion relaction they say be descreted by the persented method. In the wave spectra as emaningly high signal to colon level has been observed and theoretical reasons for this result were given. (Two-dimensional, three-dimensional wave spec-tra).

J. Geophys. Res., C, Paper 401006

4765 Surface waves, bidse, and see level that Distribution Of Massured and Simplated Wave Heights

Serial pulse story, University of California, Serbalay,
California, 9470), K. Proges, V. Stefansee, and E. T.
Eliasson.

This paper presente captylical and numerical studies
of the generating capacity of the Krafia field. A general
lumped-payments, model is developed, which can be used to
obtain rough ast basts of the generating capacity of a
speathermal field bead on the size of the wellfield, the
average formation poyosity, and the amount of racharge to
the system. The model is applied to the old wellfield at
Krafia. Note sophisticated esiculations of the generating
capacity of the Krafia field are also performed using
distributed-parameter models. Two-dimensional steal hodels
of the various castvoir regions at Krafia are developed
and their generating capacities (Mo) evaluated. The
results obtained indicate that the relative of the cast and trough we have
severed as the time of the cast and trough we have
severed the distribution developed by Tayfor to
suction a surface power polyanial of the new wellfield in the old and cap
for 50 years. To phasic the required stems properties).

As FUNCTION OF SPECTRAL SHAPS

S. FORTICAL SHAPS

G. E. FORTICAL

J. Geophys. Res., C, Paper 400961

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Interested candidates should submit a letter of intent, a curriculum vitae, and three letters of recommendation to AGU. For further details, write Member Programs Division, American Geophysical Union, 2000 Florida Avenue, N.W., Washington, D.C. 20009 or telephone 462-6903 or 800-424-2488 outside the Washington, D.C., area.

Deadline: April 1, 1985

4799 General (Coastal Dynamics) LOCAL WIND FORCING OF A COASTAL SEA AT SUB-INERTIAL FREQUENCIES J. N. Lewis (Science Applications, Inc., 2902 Lodgepole, College Station, Tr 77840) and Robert G. Reid

Lodgepole, College Station, Ts 77840) and Robert 0. Reld

An analytical, normal mode, two-layer model is presented which gives the response of a coastal region to local wind forcing. The model is linear and is developed in frequency space, the latter allowing one to compare the model responses directly with the results of current meter/wind data spectral and coherence analyses. The theoretical development indicated the requirement of a frictional parameter in both the barotropic and baroclinic redes to belance the wind stress at lower frequencies. Experimentation with the nodel and current and wind data collected 20 to off the Teres coast showed the sub-inertial fraquency range.

With appropriate frictional parameters, the model predicts the response of the Texas coastal region to local wind forcing quite well using data from the fall and winter of 1978-1979. However, during the surrar of 1978, the model consistantly under-predicted the energy leaves of the currents. Since the summer is a period of low wind stress energy for the Texas shelf, this under-prediction cost likely indicates the presence of non-locally-generated their wave phenomena. (Air/sea interaction, coastal dynamics, analytical radel).

J. Geophys. Res., C, Paper 4E1003

Particles and Fields— Interplanetary Space

CHARACTERISTICS OF EMERGETIC PARTICLE EVENTS
ASSOCIATED WITH INTERPLANTARY SHOCKS
K.-P. Venuel (Space Science Bep., ESTEC, 2200, AD
Hoodwijk, The Metharlands), R. Reishard, Y.R.
Sanderson and E.T. Sarris.
We present observations of the 35-1600 keV proton
intensity-time profiles and the three-discussional 3556 beV asisotropy distributions recorded during two
interplanetary shoch events on ISEE-3, and discuss
these in the light of current particle acceleration
and in the light of current particle acceleration these in the light of current particle acceleration models. The large 5 april 1979 event associated with a quasi-parallel shock about an extended Coreshock region with a strong increase of the upstream proton flux, a downstream platesu-like profile, apatream flux from the shock and downstream isotropy in the soliar wind frame of reference. The small-9 Herch 1979 event has a structured intensity-rise profite, 4 narrow shock spike and anisotropic engular distributions both shock uplies and anisotropic angular distributions both up— and downstream, the anisotropies immediately behind the shock anthiting an intensity peak at pitch angles around 90°. The Appil went representative for a class of large Canargatic Store Particle (188) events shows many observational features which are in agreement with predictions made by diffusive shock acceleration models. The March ovent representative for a class of events with irregular profiles and sainly essociated with questionspendicular shocks swithits features which are characteristic of shock diff sectorarion. We conclude that both acculeration models are operative in asspectation with interplanetary shocks. (Shock waves, comic rays)

SHO Shook Wares NOOFFICHING PROCESS NOOFFICHING TO SHOOK FITTING PROCESS NOOFFICHING TO SHOOK FITTING PROCESS NOO. BASK-Goddard Space Plight Conter, Greenbelt, Maryland 20771) and B. P. Lepping A scalified form of the Lepping-Argentiero single spacecraft, shock normal determination procedure is presented. The modified matted incorporates a simple presented. The modified matted incorporates a simple presented. The modified matted incorporates a simple presented for the parameters for the starting vector. (Shock normal techniques, solar wind plasses, magnetic fields).

J. Goophys. Rem., A, Paper 4A8159.

Chapman Conference

Solar Wind-Magnetosphere Coupling

Convenors: Y. Kamide and J. A. Slavin

February 12-15, 1984

Jet Propulsion Laboratory, California Institute of Technology

The purpose of the conference is to focus attention on the solar wind-magnetosphere coupling problem, to provide a timely forum for the exchange of ideas, and to promote interdisciplinary collaboration between the various solar terrestrial investigators.

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Program Committee: D. N. Baker, Los Alamos National Laboratory, S. W. H. Cowley, Imperial College; D. A. Hardy, Air Force Geophysical Laboratory; Y. Kamide, Kyoto Sangyo University; J. H. King, NASA/Goddard Space Flight Center; L. Lee, University of Alaska; R. L. McPherron, University of California, Los Angeles; G. Rostoker, University of Alberta; G. L. Siscoe University of California, Los Angeles; J. A. Slavin, JPL, Caltech.

Information circulars regarding this conference may be obtained by writing to Solar Wind Coupling Meeting, AGU, 2000 Florida Avenue, N.W., Washington, D.C. 20009.

Abstract Deadline: November 1, 1984

5140 Shock Waves
THE SECO'M ORBER THEORY OF ELECTROMAGNETIC
NOT TOR BEAM INSTABILITIES
5.P. Gary (Space Plasma Shysics, ESS-8, los
Alaros National Laboratory, los Alaros, Na
87515) and Ral. Towar
The Mave-particle interactions of a hot ion
bean streining along a negoetic field 8 are
studied. A second-order theory of electroregnetic instabilities in a horogenous, collisionless plasma at propagation parallel to
8 is used. The ten instabilities most likely
to be driven by a hot been are the right hand
and left hand resonant ion beam instabiltités. If the conditions necessary for the
validity of the theory are met, the tendrodes
are found to reinforce one another. That is,
each rode acts to produce a beam anisotropy
which reduces its own growth rate, but enhynces the growth rate of the other. Thu
this theory predicts that, whenever sufficiently hot or "diffuse" ions are found at
collisionless shock and the plasma is sufficiently hotogenous that significant wave
growth is possible, ion bear instabilities
will act to produce a nisture of both right
and left had polarized MiQ-like waves.

J. Grobbys, Res. A. Paper 188123

J. Geophys. Res., A. Paper 438124

Sign Solar wind plasma
TEMPORAL EVOLUTION OF THE SOLAR WIND ARD THE FORMATION
OF A STANDING SECK
Instia R. Mattel (Marvard-Seithagaian Center for
introphysics, to Carden St., Cambridge, PA. 02135),
fobert Bosnar
The temporal evolution of the solar wind from one
steady state to another is explored when gomentum
deposition produces sultiple critical points in the
flow. Ye show that the wind always evolves in size to
a new steady state ecopatible with the solution of the
steady state equation of notion. However, for the same
initial state and identical asymptotic communication raise, the imporal swolution pattern of the
wind depends on the detailed time history of promotion
addition, and is therefore not unique. This feature
plays an important role in the particular case when
writiple three in this study) steady states must for
identical boundary conditions; each one of these
solutions is thus shown to be physically accessible.
The details of the temporal evolution pattern of the
wind reveal the formation of a shock discontinuity
whenever the flow temporal and services a services.

Particles and Fields-Ionosphere

5510 Auroral some dagments effects COMPUTED MIN-LATITUDE MAYETIC FIELDS M. Sum (Reophysical Inabituse, University of Alasks, Fairbanks, Alaska, 39701), 8.44. Ahm, 5.-1. Akasofu and Y. Camide
Hisgmotic disturbance fields in the oldile latitude ingnostic disturbance fields in the citate latitude are conjusted at 5-minute intervats for inrch 17, 13 and 19, 1975 from the distribution of the high latitude immagheric currents, which was determined from the six 145 maridian chains of magnatometers through a numerical modeling nothed, tech high latitude current seagont is assumed to be connected to tea (upward and downward) field-aligned currents along the dipple field lines and a closure current in the equatorial plane of the magnetosphere, it is shorn that a significant part of the widdle latitude magnetic disturbance fields can be reproduced by the fields of such three-dimensional current systems. In

J. Geophys. Bes., A, Paper 4A1011.

1535 Latercutions Detroica Evree and Particles
THE L-SHELL EDGICH OF IMPORTANCE FOR WARE EXITTED AT
CROSHD-LEVEL AS A LOSS RECHANISH FOR TRAFFED ELECTRONS >
SPATIAL CORRELATION OF THE IONOSPHERIO TOTAL
ELECTRON CONTENT AT THE EQUATORIAL ARCHALY tahof (lockhard Fale Alto Research Laboratory, Alto, California 94304), J. B. Raugen, E. E. p. v. pariors ive of this paper is to identify the L-shall

electrons with energiae spors 68 keV. This assessment is made possible by studying the day-night differences in Inner belt electron proteiplatation and caparing with the known stronger transcission of waves through the locusphure at night sud the known bigher dayting intensities for waves of actural origin other than lightnings. Intensities of electrons trapped on drift abelts which dip below was leave in the absorbt are used to study the rates of locatrons trapped on drift abelts which dip below was leave in the absorbt are used to study the rates of loss from the radiation belts. In 1979 the finer rediation belt is shown to have had the following unique features for electrons > 68 keV; 1) the rates of procipitation for electrons > 68 keV; 2) the trates of procipitation for electrons > 68 keV; 2) the contract which the procipitation on other L shells in contract with the daytice practipitation in which a significant correlation exists with the pracipitation on other L shells in contract which the pracipitation on other L shells in contract throughout the range L = 1.2 - 5.0. From these raphrical findings one conclusions that in the banet of the fines radiation belt lightning and/or transmitter generated waves smitted from ground leave probably played a significant role in precipitating elevinons > 68 keV at nightning radiation belt lightning and/or transmitter generated waves smitted true ground leave probably played a significant role in precipitating elevinons > 68 keV at nightning radiation belt lightning and/or transmitter generated waves smitted true ground leave probably played a significant role in precipitating elevinons > 68 keV at nightning radiation belt with the particular role in precipitating elevations and the series of injection with the procipitation in the role of the

5560 Particle Precipitation A COORDINATE SATELLITE AND GROUNDASED STODY OF AN INTERSE ELECTRON PRECIPITATION SPIKE OVER THE SOUTHERN FOLAR CA.
W. L. Imbof (Lockhend Palo Alto Research Laboratory, Palo

dusk—midnight local time sector. The set pracipitation was amountained with a poleward-moving weatward electrojet and produced the largest riometer absorption (exceeding 182 at that station, the feature examined in dutatil here is an income applie of "10 seconds duration and linited especial extent that occurred as a shortlived assiverd ionospheric current developed equatorward of the westward electrojet. At the class of the spite, two assisters on the 75-1 satellite measured assacially simultaneously x-rays from the region viewed by the ground-head instruments. However, of the spite precipitation region as return of the riometer absorption with a strip of width "25 is and length greater than 100 bm. The total flux of the spite pracipitation region is committed, with a strip of width "25 is and length greater than 100 bm. The total flux of the pracipitation region is committed, with a strip of width "25 is and length greater than 100 bm. The total flux of the pracipitation region is committed, with a strip of width "25 is and length greater than 100 bm. The total flux of the pracipitation of the miles of the spite pracipitation region is committed with a strip of width "25 is and length greater than 100 bm. The total flux of the pracipitation of "20 ions and sensery spectra of x-rays sentia of the spite pracipitation of the miles of the pracipi

J. Geophys. Bes., A, Paper 4A8085

356) Plasma motion, convection, or circulation
THE (CKANDESS MOTIONS INSIGE EQUATORIAL PLASMA SUBBLES
W. B. Hannon (Center for Spa. Sci., Physics Program,
Univ. of Tesse-Delian, Richardson, TX 7363) and D. A.
Bangboys
A preliminary study of the vertical and north-nouth
Derizontal (or motions in plasma bushles in the con-

A presiminary study of the vertical and north-south horizontal is environs in pleases bubbles in the near equatorial loss phere utilizing drift mater data from Atamaghere Emplorer R is presented. Migh resolution data show that the wartical ion velocity in some bubbles increases approximately linearly with (No. N.)/N. where N. is the bubble ion concentration and N is the bubble ion concentration at sufficiently large the bubble ion concentration that the fraction from at a value substantially larger than the ratio of the gravitesional acceleration to the ion neutral collision frequency slyval, which is the nominal collision dominated velocity limit for cylindrical bubble. These larger than nominal velocities may result from a vertically elongated bubble cross section. The unanticipated observation that large poleward bustonated driftes accompany these vertical drifts neems to inlow naturally from a cadestribution of plasma slong flux these ms the plasma convects from the bottomide of the 7 region to high slittudes.

CREST Tinn-Niem Husng (Telecommunication Laborato-ries, M.O.C., P. O. Box 71, Chung-Li, Taiwan Republic of China)

The spatial correlation of the iomospheric total electron content at the equatorial and-

J. Goophys. Res., A, Poper AA0915

maly creat was studied by recording Faraday rotation angle of the ETS-II geostationary satellite at Lumping and Kaohaiung whose sub-ionospheric points locate raspectively, at 23.0°N; 121.9°E and 20.9°N; 121.1°E, and are about 280 Km apart. The rosults show that the spatial correlation of TEC at equatorial creat region is smaller than that at other places. The day to day vortabilities of TEC differences butween two subionospheric points are quite large. The day to day variabilities of the fountain effect seems to play an important role.

J. Gosphys. Res., A. Paper 440530

J. Goophym. Res., A. Paper 4AUS63

5590 Instruments and Techniques
THE IMPLECTION FOLDY METHOD OF DETERMINING RIOMETER
(UIST DAY CHAVES
S. Krishmanusmy, D. L. Detrick and T. J. Rosenburg
(Insatitute for Physical Science and Technology,
Darversity of Maryland, Coilege Park, MD 20742)
A computer technique to described for determining the
Quier Day Corve (QPC) from Flometer measurements of
cosmic radio noise. In this technique, the QDC value

J. Goophys. Rus., A. Papur 4A0917

Volume 69 Number C6 September 20, 1984

Journal of Geophysical Research

Turbulent Wave Boundary Layers, 2, Second-Order Theory and Muss Transport (Paper 4C0824)

Coastal Flows Driven by a Local Density Flux (Paner 4C078a)

Rary O. R. Y. Thompson

David A. Brooks

John P. Blaha The Response of the Coastal Boundary Layer to Wind and Waves: Analysis of an experi Lake Eric (Paper 4C0o24)

David J. Schwab, Gny A. Meadows, John R. Bennett, Howard Schultz, Paul C. Liu, Joan E. Campbell, and Herve U. Dannelongue The Dynamics of a River-Boy-Delta System (Paper (4C0575)

Coastal Temperature and Salinity in the Northern Gulf of Alaska, 1970-1983 (Paper 4C0714) A Theoretical, Laboratory, and Field Study of Ice-Coupled Waves (Paper 4C0712) (Paper 4C0712) end

Concentration Gradients and Growth/Decay Characteristics of the Seasonal Sea Ice Cover (Paper 4C0597)

J. C. Comisso and H. J. Zwalls Microwava Emission From High Arctic Sea ice During Freeze-up (Paper 4C0673)

J. P. Hollinger, B. E. Troy, Jr., Ro. O. Ramseler, K. W. Asunts, M. F. Harman, and C. A. Lather

Sea Surface Temperatures of the Coastal Zones of France Observed by the HCMM Satellite (Paper 4C0544)

Exput. and M. Crépon the HCMM Satellite (Paper 4C0544)
P. Y. Deschamps, R. Fronin, and M. Crépou 8123

Remotely Sensed Sea Surface Temperature Variability Off California During a "Santo Ana" Ronald J. Lynn and Jan Svejkavsky 8151; Production and Distributions of Sea Spray (Paper 4C0623) Ocean Life Cycles and the Atmospheric CO₂ Content (Paper 4C0711) Tsungellung Peng and Wallace S. Broecker . \$170 The Increase in Oceanic Carbon Dioxide and the Net CO₃ Flux into the North Atlantic (Paper 4CO437)

Marita Ross and Gode Gavenhors

Analysis of a Relationship Between the Vertical Distribution of Inorganic Carbon and Biological The Effect of Particle Size on the Light Attenuation Coefficient of Natural Suspensions (Paper 4C0622)

Edward T. Baker and J. Written Lavelle Topographic Generation of an Eddy at the Edge of the East Greathand Current (Paper 4C0731)

David C. Smith IV. J. II. Mariton. J. A. Jahannessen, and N. Untersteiner

Bottont-Boundary Condition for Nonequilibrium Transport of Sediment (Paper 4C0783)

Correction to "CZCS Data Analysis in Turbid Coastal Water" by M. Violitier and B. Siurm (Paper AC(051)

for a given sidered time interval is taken to be the signal level corresponding to the indication point on the high-signal side of the peak of the distribution of the general county radio notice power for that interval. A comparison is made with earlier extends of calculating the QIC and the superiority of the present pethod is dominary stud. This cathod has been applied to NR: Tromator data from Siple station, Asserted (75°16'S, 83'18-'W) for 1975 and 1940. Rappite the presence of high levels of preparate drarefrance during some souths in 1980, the technique is able to generate usuable QN's for each mouth. The entertainty in the determination of the QC stationard to be about 0.1 dB when interference is present, but such lower at other tisses. Changes in the QC iswals from such to continuous tith expected seasons! (i.e., solar tends) and objective appointed seasons! (i.e., solar tends an objective appoint of computer calculation and frappears to be a premising tool for the detection and manitoring of long-ture variations in background radiowave absorption by the longaphers. (Piemeter, longaphers radiowave absorption). Groundwater **Transport:** Handbook of Mathematical Models (1984)

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Q. L. Wrenn and J.-E. Johnson (Mullard Space Science
Laboratory, Bolabury St. Hery, Dorking, Surrey, Eng-

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Particles and Fields— Magnetosphere

5745 Magnetospheric configuration THE EFFECIS OF DIPOLE TILL ON THE STRUCTURE OF THE THE EFFECTS OF DIPOLE TILT ON THE SIMUCTURE OF THE MAGNETOSPHÉRE.

C. C. Wy (Department of Physics, University of California, Los Angeles, California 20029)
The structure of the magnetosphere as a function of dipole tilt was studied by using a global MHD model. We show here that the cusp current sheet in the WHD model is related to the tail current wheeten that the calculated shape and positions of the tail current sheet are consistent with observations. In addition, we discuss the difference bothern the MHD model and the Chapman-Ferraro type model which manifests as a function of tilt angle. (Magnetosphere, dipole tilt, currents).

J. Gaophys. Huo., A, Paper 4A8160

5755 Plasma Instabilities
GENERATION OF CHOIMAN MUDE ELECTHOMACMETIC MADIATION
MEAR THE UPPER MYBHID FREQUENCY IN THE MAGETICS-MER.
Maha Ashbur-Abdalla linstitute of Geophysics and
Planetary Physics, University of California, ics
Angelss, California 90024) and H. Obuds
It is shown by means of plasma numerical simulations
that a long wavelength ordinary mode electromagnetic
readiation can be generated from short wavelength
electrostatic waves near the upper hybrid resonance
frequency in an inhumogeneous plasma. A possible
relation of this process to nonthermal continuum
radiation in the magnetosphere is alsoussed.
J. Geophys. Res. A. Paper 4A6946

J. Geophym. Ram., A. Paper AA0946

5755 Planma instabilities
RELATIVISTIC DISPERSION, THE CYCLOTRON MASER
INSTABILITY, AND AUBORAL KILOMETRIC RADIATION
P. L. Pritchett (Department of Physics, University of
California, too Angelea, California 90024)
The most successful explanation proposed for the
generation of surgeal Minematics and an invented and in the california of the proposed for the
generation of surgeal Minematics and an invented an act he local electron cyclotron frequency is amplified through a gyruresonant interaction. Previous act has sham that inclusion of the relativistic mass depandence of the cyclotron frequency is essential to determine the resonant confours in velocity space. In the present work it is demonstrated that relativistic effects can also significantly modify the wave dispersively, even for only middy relativistic electrons, and wape "the" C.1, which is frequently the case in the AM source region. For a relativistic Maserillan distribution in the NAM mode catolif is found to be skifted below the for type? C. (2731 $d_{\rm pop}/d_{\rm pop}$). Linear analysis of a detta-function ring distribution in p. Indicates that the H-1 mode is unstable for $d_{\rm pop}/d_{\rm pop}$. Linear analysis of a detta-function ring distribution in p. Indicates that the H-1 mode is unstable for $d_{\rm pop}/d_{\rm pop}$. The effect of finite velocity spread on the maximum growth rate is reduced considerably. The harmonic propagation and growth rate is reduced considerably. The elativistic distribution in $d_{\rm pop}/d_{\rm pop}$ is not only the sustable for non-section of a rold electron component produces a new relativistic mode with extraordinary polarization and Ro w. $d_{\rm pop}/d_{\rm pop}/d_{\rm$

G. L. Wrenn and J.F.E. Johnson (Mullard Space Science Laboratory, Solmbury St. Marry, Dorking, Surray, England)
Cold proton observations from the geosynchronous GROS-2 seclifts are presented to show the pitch augla distribution of the refilling cold ion population found beyond the plansapause. This raffilling cold ion population found beyond the plansapause. This raffilling cold ion population found beyond the plansapause. This raffilling is observed both day and night. The lone have emergies between 0.5 and 3 eV. These energy characteristics are complatent with other recent observations. Although the observed angular distribution of these lone is highly couplex, when allowance is sade for the satellite sheath several conclusions can be made concerning the long pitch angle distribution, the angular distribution is very field sligned with a characteristic source cone angle ranging from 10 to 20. This range of angles is consistent with ions originating below 20,000 km in the evosphers rather than in the heavy-ion tonosphere. As the flux tube density increases the degree of field aligneent decreases, however based on the limited pitch angle experage it is not possible to determine if the field aligneent component (a simply being swamped by the local increases; however based on the limited pitch angle aligned component thanges its not possible to determine if the field aligneent component or if the field aligned component changes its not possible to determine if the field aligned component thanges its not possible to determine if the field aligned component than the same of sheath-plasma observations. The observations were obtained by using the boundaries and voltage bisning capabilities of the detector package relative to the astellite, Those data and the standard of the describence of this sheath-plasma coupling is that a technique to make actalitie sheath observations has possible to make actalitie sheath observations has been demonstrated. (Magnetempheric, thermal, protons, attallite sheaths) J. Geophys. Ras., A, Paper 4A6048

> RECOMMIT HAMPONIC ALEVER WAVES IN THE MAGNETOSPHERE: A CASE STUDY
>
> I. Junginger (Space Science Department of ESA/ESTEC,
> Noordeljk, The Netherlands). M. Beumjohann.
>
> Sirong deyside long paried electric and segnatic field fluctuations were measured emboard the geostationary satellite £605-2 on April 11, 1979. The electric and segnatic field spectral bate in the claim of the representation of the second simultaneously for about five hours. The lower frequency pulsation with a typical paried of 250 sec is only present in the electric field data (with typical applitudes of 0.3 ml/m), whereas the higher frequency oscillation dominates the transverse magnetic field spectra (typical period 95 sec, typical amplitude 1 ml). The periods of both pulsations increase towards the dusk sector. The observed periods of the pulsations in conjunction with the measured equipartial electron densities, the ratio of the electric and megnatic field amplitudes for both frequency bands, and the constancy of the period ratio yield trong evidence that the boo frequency bands represent fundamental and second harmonic mode eigen-oscillations of geomagnetic field lines. The mean ratio between the shorter and longer periods derived from the measurements (about 0.35) is slightly different from theoretically obtained ratios, thus indicating shortcomings of currently available models. The phase relationship between the electric and megnatic field fluctuations of the save period earling indicate that the major the wave Poynting vector, and the occurrence of the event after the spring equinox indicate that the major part of the wave anary is fed into the oscillation in the southern hamisphere and not close to the equatorial plane, (geomegnatic micropulsations, electric fields, eigenoscillations).

J. Geophys. Res., A. 4A1008

5780 Nave propagation
A RECOMMILIATION OF PROPAGATION HODES OF AUROGAL KiloHOTELG RASILATION
Fore Leablance (Department of Electrical Engineering,
Kysto Dutwersity, Kysto 606, Japan)
The propagation modes of sureral kilometric radiation
(ARE) are thougetically (weekigated by 3-dimensional
Hay treat thoughtelly (weekigated by 3-dimensional The propagation modes of sureral kilosetric radiation of AKI) are theoretically investigated by 3-diamentions in the sureral plasma savity. Such right-hand extraordinary (E-N) mode and laft-hand ordinary (L-O) mode observations are explained in a consistent ammer. The following manuspilons, which are based on observations may the source, are used for the ray tracing. (1) The radiation is generated in both R-X and L-O modes. (2) the stone of the wave frequency to the R-X mode out of traces of the wave frequency to the R-X mode out of the sureral latitude of 10 to 1. (3) AKI waves into the generated at wave normal angles almost paraphologist in the generated at large of the save frequency to the R-X mode out of the sureral plasma cavity slong a night side field line with a sureral plasma cavity slong a night side field line with a generated of AKI can be well explained are consistent with the cyclotron many mechanism, (1) The R-X mode is declared to the probability of the sureral plasma cavity slong a night side of the sureral plasma cavity slong a night side field line with a sureral plasma cavity slong a night side field line with a wider region than R-X mode waves on the following two additional account of the sureral parameters with the cyclotron many mechanism, (1) The R-X mode is declared at the source, in a stronger, that the declared of the sureral parameters with the R-X mode waves annot reach because it is stronger. The L-O mode is remained at the source in the R-X mode waves annot reach because it is stronger. The L-O mode is remained at the source in the R-X mode waves annot reach because it is stronger. The L-O mode is remained at the source in the R-X mode waves annot reach because it is stronger. The L-O mode is remained at the source in the source in

Geophys. Res., A, Paper 448030

5780 Wave Propagation
SITULIANEOUS ObsERVATIONS OF POS PULBATIONS BY VHF
RADARS HPACEL 10 HOURS IN MLT
J. O. Keys 19.E.L. Atmospheric Station, D.S.I.R.,
Lauder, Cantral Otago, New Lealand).
Long period Pc5 pulsations have been recorded
simultaneously by VHF traders oversting in Scandinavia
and in New Zealand. The radars are in opposite
hemispheres and are spaced about 10 hours in socil
time. Those pulsations snalysed are either of the
"quasi-regular" variety, or take the form of demped
trains which often follow magnetic sudden reconcements.

An estimation of equatorial plane ion mass denoities shows azimuthal variations attribut several possible causes, including the presence of localised density gradients or a nignificant proportion of heavy tons. A transient type pulsation shows the effect of the two radars being directed inside and outside the plassapause, and a longer lesting event suggests a monochromatic drive of different period on the dawn and dusk flanks of the

M.C. Leg (Regts College Research Center, Weston, Mass.

Injected VLF waves and lightning-induced whistiers, it intense enough, are able to excite lower typird waves and fold-eligned density stristions in the ionosphere within a few seconds. This instability can be also triggered in the magnacephere by the injected VLF waves if the transmitter is operated continuously for several minutes. This instability can be excited in a broad whistier frequency range is two domains, wherein afther the non-oscillatory beating correct or the thermal pressure force is the dominunt continuous affect. The excitation of this instability may be responsible for the mirgiou effects associated with the VLF transmitter cycle and be possibly the cause of the lower hybrid waves correlated with the occurrence of lighesting storms. (Lower hybrid waves, field-eligond piece density striations, non-oscillatory beating current)

1. Scombus, Ros., A. Paper 440927 Injected VLF waves and lightning-induced whistlers

J. Goophys. Ros., A, Paper 4A0927

Particles and Fields--Magnetosphere

5705 Bou abook waves
A SIMPLE MODEL FOR THE FORMATION OF "REPLECTED", "INTERMEDIATE", AND "DIPPUSH" TOO DISTRIBUTIONS UNSTREAM OF
THE RARTH'S BOU SHOCK
M. A. Les (Space & Cance Canter, Physics Department,
University of New Esapebiro, Dathas, MR 03824) and

M. A. Les (Spece Soleman Canter, Poysta September, University of New Esspekirs, Darham, MR 03824) and G. Skadton

We present a simple model unifying the distinct energatic ion populations and their associated low frequency bydromagnatic waves within earth's ion fortshock. Ions initially injected onto magnetic field lines at the shock eachies hydromagnatic waves which pitch-angle scatter the ions back toward the abook. The ions are represented by inhomogeneous inward (toward the shock) and outward travelling beams, and the transition rate between boars is determined by an effective quasilinear pitch-angle diffusion coefficient for the transition. The internsition of waves resonant with the beams are calculated from wave kinetic squations utilizing linear wave growth rates which is turn are determined by the instantaneous, local beam despities. The coupled equations for the spatial and respond evolution of the ion despities and wave intensities along a given suggestic field line are solved numerically assessing steady injection of ions at the shock following the initial magnetic commetter of the field line to the bow shock. The initial interplenatory waves are assumed to be unpolarised on swerage and to propagate predominantly away form the unpreleafined to the polar wind. We find that next: connection of the final time to the should not make intrial interplanatory waves are assumed to be unpolarized on average and to propagate predominantly away from the sum relative to the polar vind. We find that (1) the ion anisotropy many the shock decrease sleetly during the initial minutes of aspectic contact, but them makes a rapid transition to a steady, "diffuse" distribution; (2) the "diffuse" ton density declines steeply away from the shock with a social-mint forward forms a broad minimum and then impressed of distribution; anisotropy to form an "distrandiste" ions the density forms a broad "raflected" ion distribution; anisotropy extending to the forements boundary; (4) the reflected and intermediate ion distributions are sould not a should realize the forement with the foreshock boundary tial bands which are aligned with the foreshock boundary and have "SHg widths; and (5) the waves associated with intermediate long are strongly Mir-polarized in the solir intermediate ions and the wave associated with diffuse ions anithin a range about sero. (Ion foreshock forms:ion, UNF wave expiration).

J. Gaophys. Rus., A, Paper 4A8209.

1. Geophys. Res., A, Paper 488209.

5720 Interactions Retwee Salur Wind and Regartrephere MARETOSPHERIC EMERCIZATION BY INTERACTION PRINCED.

1. Indexi, A. I. Devalor, and J. H. Matte, Ir. ISpace Science Laboratory, Rain/Marchall Space Flight Conter, Huntwelle, Al. 38412).

If the salar wind in capable of driving expantospheric convection, then solar-wind flow past any epitation, and canase the togentic floid lines in the outer part of its magnetized plane with a conducting incomputer must cause the togentic floid lines in the outer part of its magnetized plane with a conducting incomputer and the anapactically field-silared Birbelmal currents in the tail that flow in and near the agantiques and close by draining Pederson currents through the planetary lonesphere. The airceast of the Righelmad currents and, by current continuity, the Federson currents is, in tiret arder, independent of the angle between the planetary-enin vector and the solar-wind solarcity vactor. Enther, the total current is a function of the magnetic content of the planet, the radius of the tail, the angular volucity of planetary apin, the conductivity of the konosphere, and the solar wind speed. For Justice, Satura, Uranue, and purhaps Reptune, the power these currents deliver to the ionosphere are significant with regard to magnetospheric dynamics such as the production of autors and the yeneratics of low-frequency radio onivitions. For Recurry, Venus, Earth, Mars, and probably Pluto, these currents are relatively small, although observable effects may be marginally detectable for the rade of the Earth's magnetosphere.

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energy coupling function, and the AR index. It is found that the specific control of the specific cont

J. Geophys. Res., A. Paper 4A1979.

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CROSS-TAIL ION IMBIT IN A REALISTIC WODE INSULTIONAL
KOUTH Props, David B. Beard (Physics Department,
University of Kanway, Lawrence, Kanses 6064)
We failteed the exact ention of protons in a magnetic
fulld resisting of a planeary dipole, forward magetemphree, regentusphere, and magneticall current
system. Proton energies of fee to 19 lev were used
for the full range of pitch engine and phose. We
found the cross-tail drift velocity was approximately
independent of pitch ample and phose and proportional
to proton energy. The drift velocity is approximately
as given by the adiabatic approximation even for 20 no
proton energy which do not behave at all adiabatically
in crossing the neutral sheat where the drift occurs.
(Plasma cotion, cagnetatall, ion drift trajectories).

J. Geophys. Ros., A, Paper 4A1081.

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Alabama in Kuntavilla, Purravilla, Alabama 15899;
The stoody-matter volestimmships between the convection electric field and slectron boundary energy
disposation in the dusk succor are obtained for offequatorially misposing electrons in dipole and
dipole-plus-current sheet magnetic field configurations. (upparison of these predictions with dusk
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boundaries and electric fields shows reasonable
agreement in magnitude and general increasing trend The stody-water volusionships but the property of the stody-water volusionships but the story of the stody-water story of the story of egreement to megnitude and general increasing trend with letitude, particularly when the dipole-plus-current abset magnetic field configuration is used.

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